

THE DISTRIBUTION OF THE ORTHOPTEROIDEA IN
TENERIFE, CANARY ISLANDS, SPAIN

Contributions
of the
American Entomological Institute

Volume 8, Number 1, 1972



THE DISTRIBUTION OF THE ORTHOPTEROIDEA IN
TENERIFE, CANARY ISLANDS, SPAIN

By

S. K. Gangwere, M. Morales Martin,
and E. Morales Agacino

THE DISTRIBUTION OF THE ORTHOPTEROIDEA IN
TENERIFE, CANARY ISLANDS, SPAIN¹

By

S. K. Gangwere, M. Morales Martin, and E. Morales Agacino²

During the summer of 1970 one of the authors, S. K. Gangwere, carried out an investigation of feeding in the Orthopteroidea of Tenerife, Canary Islands, Spain, and thereby obtained some knowledge of that island and of the distribution of certain of its species. Then during his return to the United States he visited the Instituto Español de Entomología, Madrid, a museum with the world's largest collection of Canarian Orthopteroidea. These activities yielded considerable data, and placed him in contact with the second author, M. Morales Martin, who for years has been researching the Canarian orthopteroids, has an extensive private collection, and as an official of the Laboratorio de Zoología, Museo de Ciencias Naturales, Santa Cruz, has access to the collections of that organization. These circumstances presented a unique opportunity for a biogeographic study, and the two entomologists, together with the third, E. Morales Agacino, an orthopterist with especial interest in Iberian, North African, and Canarian species, availed themselves of it to collaborate in the following report, based on the several collections listed above.

During the last fifty years many publications have appeared dealing, in part, with the Tenerifean orthopteroids. Notable among them are papers by Chopard (1942, 1946, 1954), Gardner (1960), Johnsen (1970), Willemse (1936, 1949, 1950), Willemse and Bruijning (1949), and Uvarov (1948), which provide an incomplete faunal list and scattered notes on habits and distribution. Recently, Holzapfel (1970) discussed in detail the systematics and distribution of the Canarian Acridoidea, and contributed much to an understanding of the biogeography of that superfamily. However, there is still neither an up-to-date list of the entire Tenerifean fauna nor a detailed presentation of the species' distribution and habits. The present study should help to eliminate that gap in the literature.

GEOGRAPHIC AND PHYSICAL FEATURES. The Canarian Archipelago is comprised of thirteen subtropical volcanic islands, seven of which are inhabited, lying off the Atlantic coast of Africa at a point approximately 195 kilometers from Cape Juby (Rio de Oro), 1,111 kilometers from Gibraltar, and close to the Tropic of Cancer. Tenerife, the largest of the included islands, has an area of 2,053 square kilometers. It is a triangular-shaped body of land whose

¹This project was supported by Grant No. 5560, Penrose Fund, American Philosophical Society, and by a Faculty Research Award from the Graduate Division of Wayne State University. These grants were for research by the first author during the summer of 1970.

²Gangwere is Professor, Department of Biology, Wayne State University, Detroit; Morales Martin, Profesor Mercantil, Poeta Tomas Morales 17, Santa Cruz; and Morales Agacino, Chief, Departamento de Protección a la Naturaleza y al Medio Ambiente, Instituto Nacional de Investigaciones Agronómicas, Madrid.

vertices are the northeastern Punta de Anaga, the southern Punta de Rasca, and the northwestern Punta de Teno. The coasts are narrow, often in the form of rocky, precipitous cliffs, and seldom with beaches or natural ports. The surface is coursed by a central cordillera that extends like a backbone from Anaga to Teno, and is responsible for relief unusual in an area so small. The island rises abruptly from the sea, reaches 1,000 meters above sea level only a few kilometers inland, and exceeds 2,000 meters at Las Cañadas near the center of the island. Las Cañadas is a giant crater from which arises, in turn, the newer volcano Pico de Teide, whose cone thrusts 3,716 meters above sea level into the sky. (See Plate V).

The Canaries presumably arose from the sea during the Miocene, and from that time to the present Tenerife has been subjected to repeated volcanism, most recently during the 1909 eruptions of Volcan Chinyero. The soil is thin, even in the woods, where it seldom extends more than 50 centimeters deep. It has developed from the superposition of various volcanic layers of different age, modified by weathering and erosion, and cut here and there by ravines, or *barrancos*, of varying depth. The *barrancos* are authentic geologic fissures that act as temporary streams during the rainy season. There are practically no creeks, other regular water courses, or natural wells on the island; hence, the inhabitants rely on artificial water tunnels excavated from the mountainsides for drinking and irrigation.

CLIMATE. The Canarian Archipelago is close to the Tropic of Cancer, and the shores are washed by the Gulf Stream and blown by the northeasterly trade winds, or *Alisios*. Consequently, the climate is subtropical in nature, and characterized by minimal seasonal and diel fluctuations in temperature, humidity, and wind. The temperature of the surface waters of the sea inshore is approximately 22 degrees C. in summer and 18 degrees C. in winter; and on land near sea level the lowest mean monthly temperature (January) is 15.3 degrees C., while the highest (August) is only 22.4 degrees C. The mean monthly relative humidity is remarkably constant, ranging from 53% to 66% at Santa Cruz and averaging higher in the north. However, the conditions at particular stations vary according to exposure and elevation. The general conditions range from hot and dry at sea level, to rain forest at moderate windward elevations, to alpine on the high mountains, and the southern section is drier and more wind-blown than is the northern. (See Table II).

The central mountain range extending the length of the island has already been mentioned. From east to west, respectively, it arises abruptly at the Anaga Peninsula; quickly reaches elevations in excess of 1,000 meters above sea level at points in the Mercedes Mountains; declines below 600 meters of elevation in the Laguna area; rises again at the Esperanza Mountains; continues with increasing peaks that terminate eventually at lofty Teide; and then falls at Teno. This orography has important consequences with respect to the cloud-carrying winds approaching the island from the northeast. The cloud belt ranges from approximately 800 meters of altitude to 2,000 or more meters during the winter, but only about 600 to 1,200 meters during summer. Therefore, the clouds readily clear the island when in the high, winter configuration, but in summer are trapped and concentrated along the northern coast, except at the "Laguna Belt," where some filter past to the south. As a result, there are two major climatologic areas in Tenerife: a lushly vegetated, fertile *northern zone* of greater humidity and rainfall that lies buried beneath a thick cloud bank during much of the summer, and a drier *southern zone*, with reduced rainfall, and supporting an arid vegetation.

Most days are clear or feature intermittent clouds that pass rapidly over the island, but the degree of cloudiness varies with season and location. Rains are seasonal, beginning in late September or October, reaching their peak in November, and declining gradually from December through March. By April and May precipitation reaches comparatively low levels, and from June into September it virtually ceases. Thus, the rainy season coincides with fall and winter, but the temperatures then prevailing are mild, so the period is one of luxuriant plant growth and flowering in all regions except the high mountains. Likewise, the dry season coincides with summer heat, causing a pronounced browning and desiccation of the vegetation in all except the most mesic environments.

FLORA. The plant communities developed on Tenerife vary with soil, exposure, elevation, and other factors. From the periphery of the island inward, Ceballos and Ortuño (1951) listed: 1) sparsely vegetated rocky or sandy beaches or cliffs, 2) coastal scrub, 3) scattered remains of once-extensive juniper forests, 4) laurel forest and heather, 5) pine forest, 6) subalpine scrub, and 7) alpine barrens. The more important with respect to the Orthopteroidea are discussed below. (See Plate V).

The semidesert *coastal scrub zone*, a region comprising almost half of Tenerife's area, occurs throughout the periphery of the island, but is best developed in the south. It is a hot, arid, rock-strewn zone populated by a reduced number of xerophilic plants including cacti, agave, aloe, spurges (*Euphorbia*), and the decumbent ice plant *Mesembryanthemum*.

In the cloud-belt area along the northern face of the island the coastal scrub yields to evergreen *laurel forest* (so-called *Laurisilva*). This plant community of lauraceous thickets, and with well-developed undergrowth, was once extensive at moderate elevations along the entire windward side, but has been reduced by man's activities, so that the few remaining stands are restricted to the comparatively isolated Anaga Peninsula. There it intermingles with *arborescent heather* (*Fayal-brezal*), and constitutes a living remnant of the Tertiary rain forests of Europe, now extinct on the continent (Lems, 1960).

At levels above 1,000 to 1,500 meters of elevation the laurel and heather plant communities are supplanted by *pine forest* (*Pinar*). These extensive coniferous woodlands are of several types, but the dominant species is *Pinus canariensis*, a now-indigenous pine that, during the Tertiary Epoch, also grew in Europe. *P. canariensis* forms magnificent, thick forests in Tenerife, but supports an impoverished undergrowth, so the insect fauna associated with it is reduced.

At approximately 2,000 meters above sea level there appears a *subalpine scrub zone* (*Retama-codeso*), chiefly of the legume shrub *Spartocytisus nubigenus* interspersed with a reduced number of herbs. The few plant species there occur in widely separated patches that take root in volcanic ash covered by sand and pumice.

Above approximately 2,700 meters of elevation the subalpine scrub gives way to austere *alpine barrens*. Once into the latter, nothing grows except a lichen, a moss, and *Viola cheiranthifolia*, found living in the lava up to within a few meters of the very summit of Teide.

The foregoing concerns the natural regions of Tenerife, but many parts of the island are not natural, being extensively cultivated, and here and there urbanized. The most important crop plant grown is banana, but orange, tobacco, tomato, potato, grain, almond, onion, and many other crops are planted.

Along the roadsides are found eucalyptus, cedar, mimosa, casuarina, palm, and other trees, as well as a profusion of flowering jasmine, heliotrope, datura, geranium, bougainvillea, magnolia, poinsettia, and other tropical and subtropical vines, shrubs, and herbs, many of them introduced.

The flora of Tenerife is incredibly extensive and diversified for so small an area. In a total land area of only 2,053 square kilometers are found 1,079 species of vascular plants, 91 of which are endemic to this island and another 247 endemic to the Canaries and related islands (Lems, 1960). This flora, an admixture of the native and the introduced, is comprised largely of Mediterranean, endemic, and cosmopolitan species, but also includes Ethiopian and other elements, mostly of a tropical or subtropical nature.

Approximately one-third of the Canarian plants are endemic. This heightened incidence of endemism presumably stems from geographic isolation and distinct ecological zonation and stratification, stemming from an orography-induced multiplicity of climates and microclimates--hence, much of the interest that the Archipelago holds for botanists. No less significant is the existence in the Canaries of certain Tertiary species. These plants, which include the laurels mentioned earlier, as well as the Canary Pine and the Canary Dragon-tree (*Dracaena draco*), a gnarled tree lily, probably reached the islands during the Miocene or Pliocene, and constitute a present-day reproduction of the ancient forests that once prevailed in southern Europe; today they are extinct on the continent, represented only by fossils (Lems, 1960).

COLLECTION LOCALITIES. One hundred twenty-nine collection localities are herein cited for Tenerife. They are alphabetized and numbered, which permits space-saving numerical designation in Table I. The code is as follows:

1) Adeje; 2) Afur; 3) Agua Garcia; 4) Agua Garcia, Ravelo de; 5) Aguamansa; 6) Aguamansa, Los Organos de; 7) Aguirre, Monte; 8) Anaga, Monte; 9) Arico; 10) Arafo; 11) Arico Viejo; 12) Arico, Las Montañetas de; 13) Bailadero=El Bailadero; 14) Bajamar; 15) Bermeja, Montaña; 16) Buenavista; 17) Bufadero, Barranco de=Barranco Bufadero; 18) Cañadas=Las Cañadas del Teide; 19) Candelaria; 20) Catalanes, Alto de; 21) Chio; 22) Cristianos=Los Cristianos; 23) Cuesta=La Cuesta; 24) Cuesta, Montaña Guerra de la; 25) Diego Hernandez, Cañada de; 26) Esperanza=La Esperanza; 27) Esperanza, Hoya de las Raices de la; 28) Fuente Fria; 29) Fuente Guillen=Hortigal Alto; 30) Fuente Joco; 31) Galletas=Las Galletas; 32) Garachico; 33) Garachico, La Montañeta, Los Castaños de; 34) Gigantes=Los Gigantes; 35) Granadilla; 36) Granadilla, Pinar de; 37) Grande, Barranco=Barranco Grande; 38) Guajara, Pie de; 39) Guamasa; 40) Guancheros, Cañada de los; 41) Guayonje, Barranco de; 42) Guerra, Valle de; 43) Guimar; 44) Guimar, Arenales de; 45) Guimar, Montaña Grande de; 46) Guimar, Volcan de; 47) Hierro, Barranco del; 48) Hondo, Barranco=Barranco Hondo; 49) Icod; 50) Icod, Las Abiertas de; 51) Icod, Pinar de; 52) Icod, Volcan Chinyero de; 53) Iguete; 54) Iguete de S. Andres, Carretera de; 55) Infierno, Barranco del; 56) Izaña; 57) Jardina; 58) Jimenez, Valle de; 59) Juncos, Barranco de los; 60) Laguna=La Laguna; 61) Laguna, Gallardina; 62) Laguna, San Roque de la; 63) Laguneta; 64) Laguneta Alta; 65) Lagunetas=Las Lagunetas; 66) Leña, Barranco de la; 67) Llano los Loros; 68) Llano de Maja; 69) Martianez, Barranco de; 70) Masca; 71) Masca, Valle de; 72) Matanza=La Matanza; 73) Medano=El Medano; 74) Medano, Arenales del; 75) Medano, Montaña Roja del; 76) Medida, Costa de la; 77) Mercedes=Las Mercedes; 78) Mesa Mota; 79) Mesas=Las Mesas=Monte de las Mesas; 80) Monton de Trigo, Caña-

da del; 81) Ninfa, Barranco de la; 82) Ofra, Montaña de; 83) Orotava=La Orotava; 84) Poris de Abona; 85) Portillo=El Portillo; 86) Portillo, Cañada del; 87) Puerto de la Cruz; 88) Punta del Hidalgo; 89) Rambla=La Rambla; 90) Realejo; 91) Rodeos=Los Rodeos; 92) Roque de Caramujo; 93) San Andres; 94) San Andres, Barranco de; 95) San Andres, Carretera de; 96) San Diego; 97) San Isidro; 98) San Isidro, Carretera de; 99) San Jose, Barranco de; 100) San Juan de la Rambla; 101) San Juan, Puerto de; 102) Santa Cruz; 103) Santa Cruz, Barrio Salud Alto de; 104) Santa Cruz, Finca Oramas de; 105) Santa Ursula; 106) Santa Ursula, Finca Malpais de; 107) Santiago, Valle de; 108) Santos, Barranco de=Barranco Santos; 109) Sauzal; 110) Seco, Barranco de=Barranco Seco; 111) Silos, Monte de los=Monte del Agua; 112) Tabares, Valle de; 113) Taco, Montaña de; 114) Tacoronte; 115) Taganana; 116) Taganana, Vueltas de; 117) Tahodio, Barranco de=Barranco Tahodio; 118) Tahodio, Charca de; 119) Tanque=El Tanque; 120) Tegueste; 121) Teide, Alta Vista del; 122) Tejina; 123) Tejina, Costa de; 124) Ten-Bel, Las Galletas; 125) Teno; 126) Tigaiga, Ladera de; 127) Vega=La Vega; 128) Vilaflor; 129) Vilaflor, Pinar de.

RESULTS

The results of this study are summarized in the Biological Notes and in Table I. That table, presented in the final section of this report, gives a provisional list of the Tenerifean species, their world distribution, their distribution within the island, their Tenerifean distribution type, and their seasonal periodism.

DISCUSSION

FAUNA. One would expect the Canarian orthopteroid fauna, an insular assemblage, to be more impoverished than are the continental faunae at the same general latitude, and indeed this is the case; the Canaries correspond in latitude to southern Morocco, where the fauna is undeniably richer. However, for a fauna isolated on a small archipelago separated by a wide expanse of water from others, the Canarian fauna is comparatively rich and diverse. That of Tenerife, the only Canarian fauna here treated, numbers 88 species (13 Blattoidea, 7 Mantoidea, 12 Tettigonoidea, 15 Grylloidea, 29 Acridoidea, and 12 Dermaptera) belonging to 31 subfamilies and 58 genera. Thus, this fauna is reasonably representative, for among its species are included members of all major superfamilies except the Phasmoidea, or walking-sticks. (See Table I).

Much of the interest that the Tenerifean fauna has elicited in the past is based not on numbers of species and groups but on the presence of species with unusual geographic distribution. Many are autochthonous; a total of 24 of the species (27%) and 6 of the genera (10%) are endemic either to Tenerife or to the Canaries in general. The percentage of endemic species per group varies somewhat, ranging from 58% (Dermaptera), to 33% (Tettigonoidea), to 29% (Mantoidea), to 23% (Blattoidea), to 21% (Acridoidea), to 13% (Grylloidea). Several of the endemics appear to be relicts from faunae that in long-gone ages inhabited other parts of the world. A good example is *Anataelia canariensis*, a representative of the archaic earwig group Protodermaptera (Fernandez, 1966).

The affinities of the Tenerifean fauna are mostly North African, for a good number of its species are either native to, or closely related to, forms

of nearby Morocco and related lands. Nevertheless, it also contains many general Mediterranean, Ethiopian, and cosmopolitan species. An examination of Table I reveals that 30 Tenerifean species are Mediterranean or Mediterranean-Palearctic in world distribution; 16 species Ethiopian, Mediterranean and Ethiopian, or Mediterranean and Afro-Asian; 14 species cosmopolitan or tropicopolitan; 4 species essentially Holarctic; and the remaining 24 species endemic. With respect to the Tenerifean genera 15 prove to be essentially Mediterranean or Mediterranean-Palearctic in world distribution; 2 genera Ethiopian; 4 genera occur both within the Ethiopian and the Palearctic realms; 19 genera cosmopolitan or tropicopolitan; 11 genera globally widespread, being Ethiopian, Palearctic, Oriental, and sometimes even Australian or Neotropical in distribution; and 6 genera endemic.

One-hundred per cent of the autochthonous species of the superfamilies Blattoidea, Mantoidea, Tettigonoidea, Grylloidea, and the order Dermaptera prove to be either brachypterous or apterous in at least one of the sexes. This suggests a direct, positive correlation between endemism and meiopterism (brachyptery or aptery), a relationship not invalidated by the fact that several non-endemic species also have reduced wings. However, the correlation is not invariable, for 6 species of Acridoidea are endemic to Tenerife, yet only two are brachypterous.

These facts have a bearing on adaptive radiation. Water is a barrier to orthopteroids and many other terrestrial insect species, which means that a given island comes to be inhabited only by those forms able to immigrate. Once a terrestrial population has surmounted this barrier, and has become established in the isolated environment, it may, comparatively speaking, be without competition, and quickly undergo adaptive radiation to meet the varying requirements of particular habitats. In Tenerife and similar islands, strongly isolated geographically, and also highly zoned and stratified ecologically, the potential habitats open to species are numerous, and the occupying fauna may develop in diversity beyond that normally expected.

Based on the foregoing, it is apparent that Tenerife has a comparatively high percentage of endemic species that, with the exception of the acridoids, are of reduced vagility owing to meiopterism. Moreover, they tend to be specialized in habitat selection. Some of them, for example, the earwig *Anataelia canariensis* and the katydid *Canariola nubigena*, could be relict forms that long have inhabited Tenerife, but most are assuredly recent to the island. Clearly, even the brachypterous and apterous orthopteroids are capable of being transported passively the approximate 195 kilometers from the African mainland, and many could have come to occupy the island in that manner, while the stronger fliers, such as the locust *Schistocerca gregaria*, can easily negotiate this distance by wing.

The evolution of distributional patterns, endemism, and their possible relation to meiopterism are of tremendous interest, but require detailed analysis of orthopteroid distributions on other islands of the archipelago and on the continent. Inasmuch as the data herein pertain only to Tenerife they are insufficient to enable anything more ambitious than has already been attempted. However, the reader may turn to Holzapfel's excellent discussion of these matters with respect to the Canarian Acridoidea (1970).

DISTRIBUTIONAL ANALYSIS. A provisional list of species was compiled using the collections of M. Morales Martin, those of the Laboratorio de Zoología, and those of the Instituto Español de Entomología. This list, modified in

accordance with recent literature, was then used as the system against which all available distributional data were plotted. The locality data of each species were plotted on an individual map, the maps compared with one another, and from these data a classification of distributional types erected. This information, together with remarks on world distribution and seasonal periodism, is presented in Table I.

The basic information just mentioned is, of course, nothing more than a series of dots on a map, each representing a particular locality from which one or more specimens of a species have been taken. A hypothetical distribution was derived therefrom by assuming that the range is continuous, which allows the dots to be interconnected to form an area on the map generally suggestive of the species' true distribution. For example, if all records are clustered along the northern coast, a northern distribution is assumed. Naturally, the records are incomplete and not necessarily representative, though they are a product of random collecting by many entomologists over a period of three quarters of a century. One example is sufficient. Pattern VIIi (Plate IV) is a distribution in which a species occurs in the southern coastal area adjacent to the west coast but is lacking in the west, a similar area. Failure to be recorded from the west could stem from the fact that it does not live there, but is probably a consequence of collecting effort. The western area is removed from the island's two big population centers, and until recently did not even have a good road that enabled ready access to it.

An elaborate classification of the biogeographic areas of Tenerife was advanced by Ceballos and Ortuño (1951), based primarily on plant distribution. (See Plate V). Therefore, it was desirable to plot the orthopteroid distributions obtained during the present study against their published scheme. The fit, or lack thereof, was determined by using the following criteria: 1) the range hypothesized for a given species is based primarily on the available distributional records; 2) the range is broadened to include that part of the natural region in which the records fit, and is terminated at the adjacent physical and/or climatic barrier; and 3) the range may overlap two or more natural regions, but there can be no gap between.

The result obtained by plotting the orthopteroid distributions against the Ceballos-Ortuño zones proved less than satisfactory. Approximately one-third of the orthopteroid species fitted adequately into one or another distributional patterns consistent with the Ceballos-Ortuño scheme, but one-third did not fit at all, and another one-third proved intermediate in this respect, neither violating the scheme nor being entirely consistent with it. This is consistent with Holzapfel's findings (1970); she concluded that it is not feasible to attempt classification of the Canarian acridoids according to distribution in floristic zones.

It was considered that a much better fit might be obtained by plotting the orthopteroid distributions against elevation as modified by exposure. The fit, or lack thereof, was investigated using the same criteria as before, and the results indicate a gratifying overall agreement. Only two species, *Canariola nubigena* and *Guanchia canariensis*, have ranges inconsistent with elevational zones as modified by exposure; four other species proved somewhat inconsistent; and the remaining 76 species were consistent with the new scheme.

PATTERNS OF DISTRIBUTION. The orthopteroid distributions examined fall into 37 provisional patterns (explained in Plates I-IV) that can be aggregated into seven major categories, as follows:

I. Ubiquitous or essentially ubiquitous. 8 spp. The insects with this distribution are recorded from throughout the island, except sometimes the heights of Las Cañadas or the western coast.

II. Southern. 8 spp. Two of these distributions are little more than expanded southern coastal distributions, while the third (Pattern IIa) encompasses all but the northern coast of the island.

III. Eastern. 5 spp. These distributions involve roughly the eastern third of the island, except for Pattern IIIc, which is a narrow tongue-like distribution extending from Santa Cruz to Esperanza.

IV. Northern. 14 spp. These insects have ranges that are little more than expanded northern coastal distributions, except for Pattern IVa, which takes in the entire north, as well as the central heights of Las Cañadas, and Pattern IVe, which includes the northcentral area, as well as a tongue of land curling southward around Las Cañadas.

V. Eastern crescent. 7 spp. This distribution is characterized by occupancy of both northern and southern coasts as joined in the east. Such patterns are but expanded coastal distributions, and their failure to extend onto the western coast is possibly explicable on the basis of insufficient collecting.

VI. Interior. 11 spp. These distributions involve one or another segments of the central mountain range that extends the length of the island from Anaga to Teno.

VII. Coastal. 29 spp. These littoral distributions, from coastline up to about 600 meters above sea level, involve the entire coast, or one or another parts of it, and sometimes the "Laguna Belt." The latter is a low, inland extension of coast between the Mercedes and Esperanza Mountains, to the east and west, respectively. (See Patterns VIIc, VIIe, and VIIf). The southern and western coasts of the island are similar, so the absence of certain southern coastal species from the west (for example, Pattern VIIi) is possibly explicable on the basis of insufficient collecting.

Based on the foregoing we can characterize the distributional patterns of the major orthopteroid groups as follows:

The Blattoidea have an essentially coastal distribution; only one species, *Arbiblatta bivittata*, extends any great distance into the interior.

One mantis, *Ameles limbata*, is virtually ubiquitous; two others, *A. gracilis* and *Pseudoyersinia teydeana*, have interior distributions; and the remaining species are essentially coastal insects.

Except for the ubiquitous *Phaneroptera nana sparsa* the Tettigonoidea, or katydids, are restricted to the north or northeast of the island, especially interior zones.

The interior *Gryllomorpha canariensis*, the eastern *Acheta meridionalis*, the northern *Gryllus bimaculatus*, and the northern and central *Oecanthus pelucens* are non-coastal species of crickets. The remaining Grylloidea are essentially coastal in distribution, though some extend well inland.

The distributional patterns of the Acridoidea do not readily lend themselves to characterization, for, as a group, they are highly varied. Some species are essentially ubiquitous; some coastal; some eastern; some northern; and some are interior forms.

The Dermaptera, like the Acridoidea, are variable in their distribution. Some species are distributed throughout the north or the south of the island; some in the interior; and some along the coast, often with considerable extensions inland.

ORTHOPTEROID FAUNAL REGIONS. According to the Ceballos-Ortuño scheme (1951), based primarily on plant distribution, the island of Tenerife is characterized by the following biogeographic regions: low scrub, juniper forest (*Sabinar*), laurel forest (*Laurisilva*), pine forest (*Pinar*), scrub (*Escobonal*), subalpine scrub (*Retama-codeso*), and alpine barrens (*Violeta*). (See Plate V). We have noted that the island's orthopteroid distributions are inconsistent with this plan. There is partial agreement, but, of course, that is expected, for the Ceballos-Ortuño zones are themselves predicated in part on elevation, climate, and exposure.

Based on the present study, there is an additional zone to be recognized, the beach zone; and the juniper forest, escobonal scrub, and alpine barrens are not important in the distribution of orthopteroids; the laurel forest is of some importance, though it does not support a unique fauna; and the low scrub, pine forest, and subalpine scrub are unique areas populated by distinct orthopteroid faunae.

Let us comment on the important zones, paying especial attention to orthopteroids unique and exclusive to them (marked *u*, below) and those so commonly encountered there as to be considered typical of them (*t*, below).

The *beach zone* features a rocky or sandy substrate, black because of the island's volcanic origin, and a depauperate vegetation. Several orthopteroids belong here: *Acrotylus i. insubricus* (*t*), *Anataelia canariensis* (*u*), *Labidura riparia* (*u*), *Mogoplistes squamiger* (*u*), *Wernerella picteti* (*t*).

The *sublittoral scrub zone* is best developed along the southern coast at elevations below 600 meters. It is an arid, semidesert region supporting a reduced number of xerophilic plants. The orthopteroid fauna that frequents it is best characterized by: *Calliptamus plebeius* (*t*), *Oedipoda canariensis* (*t*), *Sphingonotus* spp. (*t*), *Stenohippus epacromioides* (*u*), *Wernerella picteti* (*t*).

The *tropical forest zone*, or laurel forest, is an area of lush plant growth developed in that part of the northeastern face of Tenerife that is exposed to the summer cloud belt. Here, among the wooded ravines occurs a somewhat distinctive orthopteroid fauna including: *Arbiblatta bivittata* (*t*), *Ariagona margaritae* (*t*), *Calliphona königi* (*t*), *Platycleis* spp. (*t*), *Tessellana tessellata* (*t*). However, several of these elements are shared with the central forest zone, and none seems to be unique.

The *central forest zone*, or pine zone, occurs at middle elevations up to about 2,000 meters above sea level, and supports meadows and other kinds of communities, as well as luxuriant pine forests. Prominent among the orthopteroids that occur here are: *Acrotylus patruelis* (*t*), *Ameles gracilis* (*u*), *Calliptamus plebeius* (*t*), *Canariola willemsei* (*u*), *Platycleis sabulosa* (*t*), *Tessellana tessellata* (*t*).

The *subalpine scrub zone* is located above 2,000 meters of elevation. It is populated by a sparse growth of herbs and legume shrubs separated by expanses of bare ground, and is characterized by: *Arbiblatta bivittata* (*t*), *Calliptamus plebeius* (*t*), *Pseudoyersinia teydeana* (*u*), *Sphingonotus willemsei* (*u*).

The above classification of Tenerifean distributional zones is somewhat different from that postulated by Holzapfel (1970), who based hers on the occurrence of acridoids throughout the entire archipelago. She recognized *open beach*, *below 300 meter xerophytic*, *300-500 meter forest*, and *above 1,500 meter subalpine vegetational belts*. The differences between the two systems appears mostly discretionary. Whether one accepts 300 meters of elevation, 600 meters, or some figure between those values as the boundary between the

xerophytic and forest communities depends on a number of variables, including location (whether on the northern coast, where the lower estimate is preferable, or on the southern coast, where the higher figure is probably more realistic), as well as the species of concern. Holzapfel dealt only with the acridoids, whereas the present report concerns the Orthopteroidea as a whole. Likewise, the choice between 1,500 meters of elevation or 2,000 meters must be based in good part on discretion, for that boundary, too, varies with location. Finally, there is the rain forest that is here recognized, though with reservations, but is aggregated with the general forest category by Holzapfel.

PHENOLOGY. The seasonal occurrence of the Orthopteroidea is as much an aspect of their distribution as is place of occurrence. Therefore, it is of interest to consider their annual cycle on Tenerife. However, at the outset it must be stressed that the seasonal data available to the writers (see Table I) are in some cases fragmentary.

In general, the Orthopteroidea respond to the mild, subtropical Canarian climate in the expected manner. They tend to be active all year long, and either nymphs or adults may be taken at any time from within the preferred habitats. These remarks pertain, of course, to species found below 1,500 meters of elevation and especially to littoral forms in areas exposed to the sun. In contrast, the orthopteroids that are restricted to subalpine and other high zones are forced into a diapause during the unfavorable winter months, and do not appear as nymphs until spring and as adults until summer.

Inherent within most orthopteroids is a pronounced population fluctuation that is only in part taken into account in Table I; all that table shows is that an individual of a given species was collected during a particular month, but that species may actually have been so reduced in number that it was almost non-existent at that time. Such population fluctuations are maximized in the case of subalpine forms and minimized in littoral forms.

Several patterns of seasonal occurrence are discernible with respect to the major orthopteroid groups of Tenerife (Table I):

The Blattoidea are coastal forms, and, in accordance with that subtropical distribution, can be found adult all year long. The majority of the species are domiciliary, and in cases where sufficient records are available appear to produce many generations per year. The native species, too, are adult throughout the year, and at some points within their range are probably also continuous reproducers throughout the year.

The Mantoidea have an adult occurrence that encompasses spring and summer and occasionally fall.

The Tettigonoidea prove more variable than do the foregoing, but all except the ubiquitous *Phaneroptera nana sparsa* have a definite seasonal periodism. In most instances it is one in which adults occur from spring until autumn.

The Grylloidea tend to be adult throughout the year, a condition in accordance with their mostly coastal distribution. It is difficult to say whether they produce one or several generations per year, but probably those several species that are semi-domestic are of the latter type.

Virtually all of the Acridoidea for which there are sufficient data to make an assessment can be found in the adult condition throughout the year. The major exceptions are *Calliptamus plebeius*, a ubiquitous species, *Schistocerca gregaria*, a plague locust that repopulates the island as the fall winds from the Sahara descend upon it, *Sphingonotus willemsei*, a subalpine species, and *Oedaleus decorus*. However, it is doubtful that the acridoids as a group produce

more than one generation per year; they are simply long-lived.

In general, the Dermaptera give evidence of being adult throughout the year, and most species probably have several generations per year. The possible exceptions are a few species in which the data are too incomplete to permit evaluation.

BIOLOGICAL NOTES

Arbiblatta bivittata. A delicate endemic cockroach, winged in the male sex, wingless in the female, this species is found throughout the northern part of Tenerife. It is especially characteristic of the laurel and pine forests, where it takes refuge in humus, soil crevices, leaf litter (especially of *Aeonium*), tree hollows, and under stones. It also lives under similar conditions up to 2,500 meters in the high mountains and less often in the lower zones of the north down to 300 meters above sea level. Adults are abundant all year long throughout the range, except at Teide during the harsh winter months.

Blattella germanica. A domestic species characteristic of the coastal districts, especially the port cities, of Tenerife. Adults occur throughout the year.

Loboptera canariensis. This small, wingless endemic is taken at Santa Cruz and San Diego, a distribution within the "Laguna Belt," which is an inland extension of coast between the Esperanza and Mercedes Mountains.

Loboptera decipiens. Under leaves, stones, and debris in woodlands from Esperanza through into Mercedes.

Loboptera fortunata. Another endemic, this moderate-sized, wingless cockroach is found along the northern coast and Anaga Peninsula of Tenerife. In the latter it is readily taken under stones at El Bailadero, but is never truly abundant. It is adult throughout the year.

Blatta orientalis. A domestic species that occurs at El Medano and La Laguna, a southern coastal distribution.

Periplaneta americana. A domestic species with a coastal distribution in Tenerife and especially characteristic of the port cities. Adults are taken throughout the year.

Periplaneta australasiae. A domestic species recorded from the "Laguna Belt," a coastal distribution.

Periplaneta brunnea. The single specimen taken of this domestic species is from La Laguna.

Leucophaea maderae. This cosmopolitan cockroach, another domestic species, has a coastal distribution in Tenerife.

Pycnoscelis surinamensis. A domestic cockroach found in cities and villages throughout coastal Tenerife. Adults are not recorded from autumn, but probably occur then too.

Zetha vestita. This small cockroach, winged in the male sex, vestigial-winged in the female, is an adventive from the Neotropical Realm. It is here recorded from boxes of bananas in San Isidro, La Laguna, and Bajamar (another version of the "Laguna Belt") and from Santa Ursula along the northern coast. It is adult throughout the year.

Leurolestes circumvagans. A few specimens of this domestic cockroach are at hand from Granadilla and Santa Cruz, a southern coastal distribution.

Ameles gracilis. This mantis, winged in the male sex, vestigial-winged in the female, has an inland distribution. It lives on the ground or on shrubs from the pine forests of Esperanza through Aguamansa to the Cañada de Diego Hernandez. The available records of adults suggest a summer-fall periodism for that life stage.

Ameles limbata. This thamnophilous mantis, similar to the preceding in appearance, size, and habits, is more widespread, having an essentially ubiquitous distribution within Tenerife. Nonetheless, it is never abundant. Adults are encountered from April through December.

Pseudoyersinia subaptera. A small vestigial-winged mantis, this endemic has a southern distribution. It is phytophilous, generally on herbs and small shrubs.

Pseudoyersinia teydeana. Another vestigial-winged endemic, this mantis is found above 2,400 meters at Las Cañadas del Teide, where it lives on herbs and shrubs, and deposits its eggs below stones. It is never abundant. Adults are encountered from March through August.

Mantis religiosa. This mantis is widespread in many parts of the Old and New Worlds. It is found in several Tenerifean localities, but is absent from the west and from the central heights about Teide, giving it an essentially crescentic distribution. It is most common near Los Rodeos and Ten-Bel, where adults are encountered on low vegetation from June through November.

Blepharopsis mendica. This large, thamnophilous mantis inhabits dry zones along the southern and northeastern coasts of Tenerife. Adults are recorded from March through October.

Hypsicorypha gracilis. This slender-bodied, phytophilous mantis has an essentially coastal distribution, with extensions inland across the Anaga Peninsula. On the basis of available records, adults seem restricted to spring and summer.

Phaneroptera nana sparsa. This small, delicate-bodied, fully winged katydid is widespread throughout the Old World, and is ubiquitous within Tenerife. It frequents both cultivated and wild situations, and is thamnophilous. Adults are encountered during all months of the year.

Canariola nubigena. This endemic meconemine is a small, vestigial-winged katydid with a caudally tumid pronotum. Based on previously published information, it is known to occur in the pine forests of Aguamansa (Willemse,

1936). However, in recent years it has also proved available in numbers in the coastal locality of Bajamar and inland in the Mercedes Forest and adjacent areas, where it lives on herbs and shrubs. Adults are encountered in the spring from February through June.

Canariola willemsei. This endemic is similar to *C. nubigena* in habits, size, and general appearance except for its shiny body surface. It is recorded only from Tacoronte and Aguamansa, an inland distribution, and on the basis of the few available records seems to be mature in autumn.

Calliphona königi. This large, powerful predator extends throughout the north of Tenerife, to which it is endemic. It is characteristic of inland woods in that part of the island, but occasionally reaches lower zones, such as at Bajamar, Guimar, and San Andres. Nymphs up to 3 cms. in length are easy to find in the typical localities, where they tend to frequent buttercup flowers. However, adults are not so often encountered, presumably owing to an arboreal habit. Adults have been repeatedly verified for the spring and summer months, and are also seen infrequently through autumn.

Ariagona margaritae. A small, vestigial-winged endemic that lives in the north of the island, especially at the edges of laurel forest above approximately 700 meters of elevation. Typical localities are Monte de las Mercedes, Las Lagunetas, and Monte de los Silos. It is found there among herbs, and is adult from July through November. It is extraordinary for its leaps, which are of unusually great velocity for a katydid of that size.

Platycleis grisea.³ A few specimens of this katydid are at hand from Tacoronte and La Esperanza, an inland distribution.

Platycleis intermedia.³ A few specimens are here listed from the "Laguna Belt." Adults are recorded from April through July.

Platycleis sabulosa.³ This moderate-sized, fully winged katydid has a northeastern and central distribution on Tenerife, where it is geophilous in dry cultivated zones or wild zones, especially in the center of the island at an elevation of approximately 500 to 1,000 meters above sea level. Records of adults are available from March through October, but the seasonal periodism could well extend beyond those limits.

Tessellana tessellata. Not unlike a small *Platycleis* (with which genus it was grouped for many years), this species has an eastern distribution and an adult occurrence that extends from March through November.

Decticus albifrons. This large, powerful, fully winged katydid is common

³The members of this genus are variable, poorly understood, and difficult taxonomically, so determinations always require great care and competence. Therefore, the records included herein, as well as those of earlier authors, should be viewed in that light.

in cultivated fields and other open places throughout the eastern and central parts of the island, and is phytophilous. Its adult periodism extends at least from March through November. This rapacious predator is widespread elsewhere, being found throughout the entire Mediterranean region.

Gryllus bimaculatus. A large, dark-bodied cricket with a palish suffusion at the base of each tegmen, *G. bimaculatus* is the most common gryllid in the Canary Islands, and elsewhere occurs through the whole of Africa and in major parts of Europe and Asia. It occurs throughout Tenerife, but is most common in the coastal zones from Puerto de San Juan through Pinar de Icod to Guimar and beyond through the Anaga Peninsula. It is found on the ground in cultivated fields and wild situations open to the sun, and is adult throughout the year. Occasionally plagues of this species composed of individuals of a body size smaller than that of the resident individuals fly over from the African continent, but on their arrival do not prove noxious.

Acheta meridionalis.³ Similar to *A. hispanicus*, below, but on the average shorter-winged, this cricket lives in the eastern part of Tenerife, and is especially common at Barranco Grande. Its habits and seasonal periodism are similar to those listed for *A. hispanicus*.

Acheta hispanicus.³ This moderate-sized, fully winged cricket lives under stones and debris near the banks of ponds, pools, and dry river beds. It is essentially southern and eastern in its Tenerifean distribution, and is adult practically all year.

Modicogryllus guanchicus.³ This cricket, smaller-bodied than the preceding and with slightly abbreviated wings, is found along the northern coast of Tenerife and across the Anaga Peninsula. It is geophilous in humid places, especially near water. Isolated records of adults are available from each of the four seasons, so it could well be adult throughout the year.

Modicogryllus palmetorum.³ Another small cricket with slightly abbreviated wings, this insect occurs at Barranco Bufadero and Charca de Tahodio, a southern coastal distribution.

Tartarogryllus burdigalensis.³ This widespread Mediterranean species finds its way to Tenerife, based on one specimen taken at El Medano along the southern coast.

Platygryllus brunneri.³ This species is a moderate-sized, fully winged geophilous cricket of tropical or subtropical distribution in the Old World. Its scattered records from Tenerife (Puerto de San Juan to Tahodio) indicate a southern and western coastal distribution on the island. Its adult seasonal periodism is uncertain, but could well involve the entire year.

Gryllomorpha canariensis. This small cricket, endemic to Tenerife, is

³*Ibid.*, p. 13.

apterous. It occurs in a great arc across the interior from near Teno to Anaga, but is never abundant. It appears to be most common in the forests of La Esperanza and Las Mercedes, where it lives under rocks and debris.

Grylloides sigillatus. This mottled brown cricket is brachypterous in the male sex and apterous in the female. It is here recorded from La Esperanza and Santa Cruz. Several of the Instituto specimens from the latter locality bear the notations "En el maiz de la Argentina" or "Comen maiz Argentina."

Mogoplistes squamiger. This is a coastal form found virtually throughout the Mediterranean area and over to Tenerife and Madeira. It is restricted to the supratidal, or "spray" zone of the sea, where it lives under stones and algae.

Cycloptiloides canariensis. This is a minute, apterous cricket endemic to Tenerife. It occurs under stones and debris in Santa Cruz and across the "Laguna Belt" to Barranco Martianez, an essentially coastal distribution.

Trigonidium cicindeloides. This minute, distinctive cricket is widely distributed in the tropical and subtropical regions of the Old World. In Tenerife it is phytophilous in cultivated places and in wild, mesic situations within the "Laguna Belt" and over to Puerto de la Cruz on the northern coast.

Oecanthus pellucens. This well-known tree cricket has an essentially Mediterranean distribution, though it extends into central Europe. It is also found in Tenerife, where it has a northern and central distribution that, with additional collecting, could prove to be virtually ubiquitous. It is thamnophilous in habit, and apparently is adult all year long.

Gryllotalpa africana. This is a small species of mole cricket known from many parts of Africa and Asia, as well as from Spain and the Canaries. It leads a fossorial existence in humid places along the southern coast of Tenerife, chiefly at El Medano and San Andres.

Paratettix meridionalis. This grouse locust extends throughout the Mediterranean region and into the Canaries. In Tenerife it occurs at the banks of pools and dry river beds throughout the island, and is especially common at El Medano and San Andres. It appears to be adult throughout the year.

Pyrgomorpha cognata. The presence of this small-bodied pyrgomorph on Tenerife is based on a record by Gardner (1960), attributed by Holzapfel (1970) to *P. cognata*. Inasmuch as Holzapfel lacked access to Gardner's material the distributional record supplied (Puerto de la Cruz, along the northern coast) remains uncertain. Nothing else is known with respect to its occurrence on Tenerife, but in Spain this geophilous insect frequents arid places open to the sun.

Arminda brunneri. The genus *Arminda*, a number of small, apterous grasshoppers related to the Mediterranean genus *Platyphyma* (= *Pezotettix*), was recently revised by Holzapfel (in press). These interesting insects are endemic to the Canarian Archipelago, and tend to be restricted to particular islands. The important species on Tenerife is *A. brunneri*. It frequents

shrubby ravines and other elevated land extending from Punta de Tenoto to Punta de Anaga. Here, dwelling principally among laurel forest remnants in excess of 1,000 meters above sea level it finds its preferred habitat, reaches its greatest abundance, and is found adult all year long. The insect also extends southward down to the onset of arid coastal scrub, living there on volcanic terrain with a largely autochthonous vegetation, but never attains great prosperity and disappears early. Its eclosion seems directly related to rainfall. The first rains of the season normally occur in September, and the insect hatches shortly thereafter. However, on occasion the rainy season is delayed until as late as December, in which case it hatches at that time.

Arminda burri. This species is known from Gran Canaria. However, in the series of Tenerifean *Arminda* examined by Holzapfel (1970) there was a male specimen from La Vega that proved indistinguishable from *A. burri*. Therefore, the Tenerifean record stands pending further study.

Calliptamus plebeius. This genus was recently reviewed by Jago (1963), who found only *C. plebeius* on the Canarian Archipelago. On Tenerife *C. plebeius* is ubiquitous, inhabiting arid situations ranging in elevation from near sea level to 2,200 meters above. It is phytophilous on stout herbs and shrubs, and is encountered in the adult condition largely during the months of June through October. The insect is striking for its marked sexual dimorphism and color variants.

Schistocerca gregaria. This large plague locust comes to the Canaries by invasion from the African continent. The normal winds that affect the island, the Trade Winds, or *Alisios*, are from the northeast, but in October or thereabout they die down, and warm winds from the Sahara Desert, the *Harmatan*, may descend upon the islands. In that event, and if there is an outbreak on the continent, this locust swarms over. During the occasional plagues, as in January, 1954, much of Tenerife is invaded, and thousands of locusts pass over Santa Cruz like a cloud. At other times this semidesert species pays only sporadic visits. Nevertheless, it is not uncommon to see isolated individuals in the east during the period October through November.

Scintharista n. notabilis. This xerophilous oedipodine has a southern and northeastern coastal distribution on Tenerife. It frequents barren lava beds and other sparsely vegetated situations extending from near sea level to 1,400 meters above. It is especially common in San Andres, where it spends much time in flight, producing a strong, clattering crepitation and showing reddish wings. It is adult throughout the year.

Oedaleus decorus. This is a pale-bodied, yellow-winged grasshopper strongly banded with dark. On Tenerife it has an interior distribution in dry, open places from La Laguna to Aguamansa. It is especially common on herbs in Las Lagunetas. Its adult periodism extends from April through November.

Locusta migratoria. This large plague locust, widely distributed throughout Africa and extending into Europe and Asia, also occurs in the Canary Islands, where it proves to be in the solitary phase, and is composed of smaller-bodied individuals than on the mainland. On Tenerife its distribution is a crescentic one from Puerto de la Cruz in the north, to Aguamansa, to El Medano

in the south, and it appears to be especially common in Los Rodeos and Tacoronte. Its habitat consists of cultivated fields, open pasture, and dry shrubby areas. It is often highly abundant, but is never noxious. It is in the adult stage throughout the year.

Oedipoda caerulescens.³ This grasshopper is listed by Holzapfel (1970) as occurring in the south and southwest of Tenerife.

Oedipoda canariensis.³ This xerophile, characterized by pale bluish wing discs, is endemic to the Canaries. It is essentially a southern and western coastal form, though it extends considerably inland in the vicinity of the "Laguna Belt." This species, typical of the genus, inhabits rocky, sandy, or bare ground exposed to full sun, but is never very abundant. Records of adult occurrence are available for all months except February and March, so it is probably adult all year long.

Sphingonotus rubescens.³ Based on the literature, this species is described as a darkish, often blotched oedipodine with transparent wings that lack the typical colored disc outlined by a dark crescent. It belongs to a genus that, like *Oedipoda*, contains many xerophilous geophiles that long have posed a problem. The group is clearly in need of revision, in connection with which Holzapfel (1970) indicated the probable necessity of using cytogenetics and behavioral studies as a supplement to traditional methods of study. She ventured the opinion that it is presently impossible to separate this species, *S. rubescens*, from three others, *S. canariensis*, *S. caerulans*, *S. savignyi*, that have been reported from the littoral and semi-desert regions of Tenerife at a level generally not exceeding 300 meters above the sea. Presently we have no recourse but to take *S. rubescens* in the old sense, though excluding it from the central heights of Las Cañadas. Interpreted this way it is virtually ubiquitous, being absent only from the highest mountains and abounding along the coasts all year long. It is adult throughout the year, but its maximal presence coincides with summer.

Sphingonotus savignyi.³ As presently understood, this contrastingly marked species has a southern coastal distribution, and it seems to be adult all year long.

Sphingonotus willemsei.³ According to Holzapfel (1970), this endemic species includes *S. teydei*. It occurs as a geophile in the subalpine desert at elevations of 2,100 meters or above, chiefly during the summer months.

Wernerella picteti. This small oedipodine is a Canarian endemic. On Tenerife it has an essentially southern and western coastal distribution up to about 1,000 meters above sea level. Adult records are available from all seasons.

Acrotylus i. insubricus. This pink-winged grasshopper is widespread within the Mediterranean region, and extends over to the Canaries. On Tenerife it has an expanded coastal distribution in xerophilous situations usually below 650 meters above sea level. It is probably adult throughout the year.

³*Ibid.*, p. 13.

Acrotylus longipes. This yellow-winged grasshopper is not listed for Tenerife by Holzapfel (1970). However, based on Morales Martin's specimens compared with determined Instituto materials, and others determined by Dirsh, it is clear that the species is represented in the fauna. It has an essentially southern coastal distribution, and is adult throughout the year.

Acrotylus patruelis. This small, pink-winged oedipodine is even more widespread than is *A. insubricus*, for it occupies roughly the same Mediterranean areas, together with the greater part of Africa. Its distribution within Tenerife is essentially ubiquitous, though it is most common in dry meadows in the interior of the island, especially at Aguamansa. It is adult throughout the year.

Aiolopus strepens. This species, a grasshopper widespread throughout the Mediterranean area, is common throughout the north of Tenerife. It primarily occupies cultivated fields, pastures, and other open grassy situations, and is adult throughout the year.

Aiolopus thalassinus. Also widespread, both elsewhere and in the Canaries, this species is often collected together with *A. strepens*. It is especially abundant at Los Rodeos and Tacoronte, but occurs throughout the island, except in the central heights. Adults can be taken at any time during the year.

Stenohippus epacromioides. There appears to be but a single species of *Stenohippus* on Tenerife. However, the name to use for it is uncertain. These delicate gomphocerines are variable, difficult to determine, and the literature confusing. Until more is known it seems best to use *S. epacromioides* (the designation used by Uvarov, 1926) in place of *S. bonneti* (cited by Chopard, 1943, and Holzapfel, 1970). The insect occurs along the southern and western coasts of the island, and is possibly most abundant near San Andres in the southeast. It is a graminicole, always being in association with lush grasses. It is adult all year long.

Doclostaurus maroccanus. This species, a plague locust whose gregarious phase has often reached outbreak populations in countries bordering the Mediterranean Sea, extends well past the Mediterranean world deep into central Asia. It also occurs, in the solitary phase, in dry, open situations throughout the north of Tenerife, and is especially common at Las Lagunetas and San Andres. It probably occurs in the adult stage throughout the year, but, as indicated by gaps in the record, the adult numbers probably decline markedly during winter.

Truxalis nasuta. This large, distinctive grasshopper has a wide distribution in the Ethiopian and Mediterranean worlds. It is also known from Gran Canaria and, based on a record by Gardner, 1960, from Tenerife. If the latter record is valid, that places it near Puerto de la Cruz. Little else is known about its Canarian occurrence. However, in view of our knowledge of its distribution in Spain its habitat is predictable: cultivated and uncultivated land, often sunny hillsides, where it is always in close association with grasses for food and perching.

Anataelia canariensis. This small, apterous earwig is the sole spe-

cies of a genus of Protodermaptera. The insect is endemic to Tenerife and Gomera. On Tenerife it lives along the northern coast from Bajamar to Punta de Teno, which area constitutes the most ancient terrain of the island.⁴ This distribution, together with the earwig's occurrence on the geologically similar Playa de San Sebastian of Gomera, suggests that the insect is a relict form, and opens the possibility that the two islands were united at some time during the geological past. The earwig's habitat is under stones in the supra-tidal, or "spray," zone immediately adjacent to the sea, from which area it never strays more than a few meters (Escalera, 1922, Fernandez, 1966). It is apparently adult throughout the year, though its numbers become greatly depleted during the summer months.

Labidura riparia. The cosmopolitan *Labidura riparia* frequents sandy beaches along the southern coast of Tenerife. It is associated with the underside of dry algae, and seems to be adult virtually all year.

Euborellia annulipes. This small, wingless earwig is cosmopolitan elsewhere in the world, and proves to be widespread throughout the Canarian Archipelago. On Tenerife it has a crescentic distribution, occurring in the east of the island and from there across the northern and southern shores. It lives under stones, often at the edge of the sea, and is adult throughout the year.

Anisolabis maritima. This earwig, also cosmopolitan and wingless, is essentially a southern coastal species, though on occasion it proceeds considerable distances inland. Its habits are similar to those of *E. annulipes*, being found under stones and often near the sea.

Anisolabis maxima. This large-bodied earwig, like its two relatives, *E. annulipes* and *A. maritima*, is apterous, but it differs from those two cosmopolitan species in that it is autochthonous. It occurs in forests throughout the north of Tenerife, but is most common at Monte de los Silos, Las Cañadas del Teide, and the Anaga Peninsula. It lives under stones, and is adult all year long.

Labia minor. This minute earwig with abbreviated tegmina is cosmopolitan in world distribution. On Tenerife it is found along the northern coast from Puerto de la Cruz to Taganana, with an extension inland at the "Laguna Belt." It is usually found under stones, debris, rock pile fences, and the foundations of houses.

Perirrhytus edentulus. This small earwig with abbreviated tegmina is found in Madeira as well as in several of the Canary Islands. On Tenerife it has a northern distribution, extending most of the way across the island. Adult records are from winter, spring, and summer, suggesting possible imaginal absence in fall.

Forficula auricularia. This familiar earwig is Holarctic in distribu-

⁴An Instituto Español de Entomología record of *Anataelia canariensis* from Guimar is probably a mistake, and one from La Laguna is assuredly incorrect.

tion. On Tenerife its distributional pattern is crescentic, and with further study could prove to be circular, encompassing all but the central heights about Teide. It lives in close association with stones, debris, and other kinds of shelter, and is adult throughout the year.

Guanchia cabreræ. There are five species in the genus *Guanchia*, all from the Canaries, and four occur in Tenerife. They are closely related to the several brachypterous *Forficula* that live in the Mediterranean area (Chopard, 1946). Therefore, the genus is interesting more because of its endemism rather than because of any structural specializations. These insects live exclusively in the woods, especially in laurel forests. They usually inhabit cracks in the bark of trees and the hollows of trunks, but are also found in dry leaf litter, especially that of *Aeonium*. *G. cabreræ* is endemic to Gran Canaria and Tenerife, and in the latter occurs in the north, where it seems to be adult practically all year long.

Guanchia canariensis. This geophilous earwig is endemic to Tenerife. It has a northern distribution, but extends inland as far as El Portillo. It appears to be adult during spring and summer.

Guanchia guancharia. This earwig is endemic to Gran Canaria and Tenerife. In the latter it has an inland distribution in the central and east from Aguamansa to El Bailadero.

Guanchia uxori. This geophilous earwig, endemic to Tenerife, has a northern distribution similar to that of *G. canariensis*. Adults are recorded from the winter and spring months.

Contribution No. 289
Department of Biology
Wayne State University
Detroit, Michigan 48202
U. S. A.

RÉSUMÉ

Tenerife is the largest island of the Canarian Archipelago, a group of volcanic islands off the coast of Morocco. It features a mild, uniform climate and great relief, and supports the growth of diversified biotic communities, both natural and disturbed. A comparatively rich assemblage of Orthopteroidea finds its home there.

During the last fifty years many reports have been published dealing, in part, with the Tenerifean orthopteroids, and this literature provides an incomplete faunal list and scattered notes on habits and distribution. More recently a dissertation appeared (Holzapfel, 1970) that treats the systematics and distribution of the Canarian Acridoidea, but there is still neither an up-to-date list of the entire Tenerifean fauna nor a detailed discussion of its biogeography. The present study, involving analysis of biological data and study of specimens from several collections, aims toward the partial elimination of that gap in the literature.

The Tenerifean orthopteroid fauna now numbers 88 species, including

13 Blattoidea, 7 Mantoidea, 12 Tettigonoidea, 15 Grylloidea, 29 Acridoidea, and 12 Dermaptera belonging to 31 subfamilies and 58 genera. A total of 24 of the species (27%) and 6 of the genera (10%) are endemic to the islands, and the percentage of endemic species per group ranges from as high as 58% (Dermaptera) to as low as 13% (Grylloidea), and is positively correlated with aptery or brachyptery, except in the Acridoidea.

The faunal affinities are mostly North African, but there are also many general Mediterranean, Ethiopian, and cosmopolitan representatives among the Tenerifean orthopteroids. A total of 30 of the species are Mediterranean or Mediterranean-Palearctic in world distribution; 16 species Ethiopian, Mediterranean-Ethiopian, or Mediterranean and Afro-Asian; 14 species cosmopolitan or tropicopolitan; 4 species Holarctic; and the remaining species endemic. A total of 15 of the genera prove to be Mediterranean or Mediterranean-Palearctic; 2 genera Ethiopian; 4 genera Ethiopian-Palearctic; 19 genera cosmopolitan or tropicopolitan; 11 genera globally widespread; and the remaining genera endemic.

The orthopteroid distributions fall into 37 provisional patterns (explained in Plates I-IV) that can be aggregated into seven major categories: ubiquitous, southern, eastern, northern, eastern crescent, interior, and coastal. The coastal pattern is expanded beyond the usual sense in that it also includes a low stretch of land, the "Laguna Belt," joining the northern and southern coasts at a point between the Esperanza and Mercedes mountains. This area is essentially an inland extension of coast, and many coastal species take advantage of it to live there.

The orthopteroid distributions prove inconsistent with the elaborate biogeographic scheme postulated by Ceballos and Ortuño (1951) based primarily on plant distributions. A better fit of the data is obtained by plotting the distributions against elevation as modified by exposure. On that basis the following tentative faunal regions may be recognized: beach, sublittoral scrub, tropical forest, central forest, and subalpine scrub.

The Tenerifean Orthopteroidea respond to the mild, subtropical Canarian climate in the expected manner. They tend to be active all year long, and either nymphs or adults may be taken at any time from within the preferred habitats, except in the subalpine zones. In the latter, the inhabitants undergo a diapause during the winter months, and do not appear as nymphs until spring and as adults until summer.

RESUMEN

Tenerife es la isla más extensa del Archipiélago de Las Canarias, grupo de islas volcánicas situado frente a las costas de Marruecos. Sus características, de gran relieve y suave e uniforme clima, condicionan la formación de diversas comunidades bióticas naturales e introducidos. Comparativamente es ella rica en representantes del orden Ortoptera.

Durante los últimos cincuenta años se han publicado diversos trabajos que atañen, solo en parte, a los ortópteros tinerfeños que, en su conjunto, únicamente proporcionan una lista incompleta de dicha fauna y dispersas notas sobre sus habitats y distribuciones. Recientemente Holzapfel (1, 1970) ha publicado un estudio que trata de la sistemática y distribución de los acrididos de las Canarias, pero en él no aparece una lista actual de los de la fauna tinerfeña ni una discusión detallada de su biogeografía; el presente estudio, que comprende el análisis de datos biológicos y el estudio de gran número de ejemplares de diversas colecciones, aspira, dentro de lo posible, a eliminar--aunque solo sea parcialmente--las lagunas existentes.

La fauna de Ortopteroides de Tenerife consta hoy día de 88 especies que incluyen a 13 blátidos, 7 mántidos, 12 tetigónidos, 15 grílidos, 29 acrídidos y 12 dermápteros, pertenecientes a 58 géneros y 31 subfamilias. Un total de 24 especies (27%) y de 6 géneros (10%) son endémicos de la isla, y el porcentaje de especies endémicas, por grupos, ofrece máximos del 58% (Dermaptera) y mínimos del 13% (Grylloidea), relacionados ellos con el apterismo o braquipterismo excepto en los Acridoidea.

La afinidad de esta fauna es en su mayor parte con la norteafricana, pero existen también en ella algunos representantes mediterráneos, etiòpicos y cosmopolitas. Un total de 30 especies son mediterráneas ó mediterráneas-paleárticas de distribución mundial; 16 etiòpicas, mediterráneas-etiòpicas ó mediterráneas y afro-asiáticas; 14 cosmopolitas ó tropicales; 4 holarcticas y el resto especies endémicas. 15 de sus géneros son mediterráneos ó mediterráneos-paleárticos; 2 etiòpicos; 4 etiòpicos-paleárticos; 19 cosmopolitas ó tropicales; 11 de dispersión mundial y el resto endémicos.

Con estos taxones se han hecho 37 grupos de tipo provisional (expuestos en las láminas I a IV) y reunidos, en las siete siguientes categorías principales: ubicuos, sureños, orientales, norteños, orientales ascendentes, interiores y costeros. El grupo costero comprende algo más de lo que indica la acepción usual de ese término ya, que incluye él una baja y larga faja de tierra (Paso de La Laguna), que une las costas norte y sur por un paso situado entre los montes de La Esperanza y Las Mercedes; esta área por ser esencialmente una extensión de la costa, es aprovechada por varias especies costeras para vivir en ella.

La distribución de estos Ortopteroides muestra la poca consistencia que para ellos ofrece el esquema biogeográfico aportado por Ceballos y Ortuño (1, 951) basado, principalmente, en la distribución de las plantas. Trazando su distribución sobre un mapa que descansa sobre las zonas altitudinales afectadas por la orientación, se consigue un mejor aprovechamiento de los datos existentes y con base en ello, intentamos poner de manifiesto las siguientes zonas faunísticas: litoral, sublitoral, bosque tropical, bosque central y zona subalpina.

Los Ortopteroides de Tenerife responden, como era de esperar, a las características del suave y subtropical clima del archipiélago canario. Suelen ser ellos activos durante todo el año, y tanto ninfas como adultos pueden colectarse en cualquier época en sus habitats preferidos, excepto los de la zona subalpina. En esta última, sufren una pausa durante los meses invernales y no aparecen sus ninfas hasta la primavera y en verano los adultos.

ACKNOWLEDGMENTS

The data reported herein were amassed during the tenure of the first author's grants from the American Philosophical Society and the Graduate Division of Wayne State University. Insect specimens were loaned by Sr. Dn. R. Agénjo, Director, and Srta. Dna. Vicenta Llorente del Moral, Orthopterist, of the Instituto Español de Entomología, Madrid, and by Sr. Dn. Jose Maria Fernandez, Chief, Laboratorio de Zoología, Museo de Ciencias Naturales, Santa Cruz. Sres. Fernandez, above, and E. R. S. Sventenius, Jardin de Aclimatacion de la Orotava, Puerto de la Cruz, assisted in certain plant determinations. Sres. Manuel Garcia de Viedma e Hitos, Catedrático, Escuela Técnica Superior de Ingenieros de Montes, Madrid, Jose Miguel Gonzalez Hernandez, Chief, Pat-

rimonio Forestal del Estado, Santa Cruz, and Salvador Vazquez Duque, Las Mimosas, Santa Cruz, gave advice and rendered various other professional services essential to the project. Miss Leslie A. Gangwere assisted in collecting specimens in the field. Irving J. Cantrall, Curator, Insect Division, University of Michigan, Ann Arbor, and William L. Thompson, Professor, and William Prychodko, Associate Professor, both of the Department of Biology, Wayne State University, Detroit, read the manuscript and offered suggestions of value in its improvement. Mrs. Betty Kuehn, also of the Department of Biology, Wayne State University, typed the manuscript. To the above individuals and organizations the authors are indebted.

REFERENCES

- Ceballos, L., and F. Ortuño.
1951. Estudio sobre la vegetacion y flora forestal de las Canarias Occidentales. Inst. For. Invest. Exper., Madrid. 465 pp.
- Chopard, L.
1942. Insectes Orthoptéroïdes récoltés dans les îles Atlantiques. Comm. Biol. Soc. Sci. Fenn., 8: 13 pp.
1943. Orthoptéroïdes de l'Afrique du Nord. Librairie Larose, Paris. 450 pp.
1946. Les Orthoptéroïdes des îles Atlantides. Mem. Soc. Biogr., 8: 199-208.
1954. Insectes Orthoptéroïdes récoltés aux îles Canaries par M. H. Lindberg. Comm. Biol. Soc. Sci. Fenn., 14: 15 pp.
- Escalera, F. M.
1922. Nota biológica sobre la *Anataelia canariensis* I. Bol. de Tenerife. Bol. R. Soc. Espan. Hist. Nat., 22: 157-158.
- Fernandez, J. M.
1966. La fauna entomologica Canaria y sus origenes. Publ. Mus. Arqueol. Cabildo Ins. Tenerife, 6: 61-68.
- Gangwere, S. K.
In press. Feeding behavior in the orthopteroid insects of Tenerife, Canary Islands, Spain. Yearbook Amer. Phil. Soc. 1970.
- Gardner, A. E.
1960. Odonata, Saltatoria and Dictyoptera collected by Mr. E. S. A. Baynes in the Canary Islands, 1957 to 1959. Entomologist, 93: 128-131.
- Holzapfel, C. M.
1970. Zoogeography of the Acridoidea in the Canary Islands. Univ. Mich. doct. diss.: 213 pp.
In press. Evolution in the Canary Islands. III: Two new *Armindia*, with notes on the *Armindia brunneri* complex on Tenerife. Occ. Papers Mus. Zool. Univ. Mich.
- Jago, N. D.
1963. A revision of the genus *Calliptamus* Serville. Bull. Brit. Mus. Nat. Hist., 13: 289-350.
- Johnsen, P.
1970. Notes on African Acridoidea in Danish museums. Nat. Jutland., 15: 123-162.

Lems, K.

1960. Floristic botany of the Canary Islands. *Sarracenia*, 5: 94 pp.

Uvarov, B. P.

1926. Grasshoppers from Northern Nigeria. *Trans. Ent. Soc. London*, 1925: 413-453.

1948. Tettigoniidae and Acrididae collected in 1931 on the Atlantic Islands by R. Frey and R. Stora. *Comm. Biol. Soc. Sci. Fenn.*, 8: 7 pp.

Willemse, C.

1936. Une excursion orthoptérologique aux îles Canaries. *Nat. Maandbl.*, 25: 40-42, 56-57, 72-73, 86-89, 101-103, 113-115.

1949. Addition to the knowledge of the Dermaptera and Orthoptera of the Canary Islands. *Tijdschr. voor Ent.*, 91: 7-11.

1950. Second addition to the knowledge of the Dermaptera and Orthoptera of the Canary Islands. *Tijdschr. voor Ent.*, 92: 248-250.

Willemse, C., and C. F. A. Bruijning.

1949. On a small collection of Orthoptera from the Canary Islands. *Tijdschr. voor Ent.*, 91: 23-24.

TABLE I

Annotated Provisional List of Orthopteroidea of Tenerife, Canary Islands.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
BLATTOIDEA				
Ectobiinae				
<i>Arbiblatta bivittata</i> (Brullé)	Yes: Tenerife & G. Canar- ia	3, 5, 6, 7, 8, 18, 26, 29, 43, 49, 53, 77, 78, 79, 83, 92, 111, 114, 116, 117, 128	IVa	All months ex- cept VII & XII
Pseudomopinae				
<i>Blattella germanica</i> (L.)	No: Cosmopolitan	60, 87, 102, 116, 124	Vb	I-IV, VII-VIII, X-XI
<i>Loboptera canariensis</i> (Chop.) ⁵	Yes: Tenerife	96, 102	VIII f	-----
<i>Loboptera decipiens</i> (Germ.)	No: Mediterranean	3, 29, 60, 77, 114	VIe	IV, VI-VII
<i>Loboptera fortunata</i> Kr.	Yes: Tenerife & La Palma	7, 13, 49, 60, 116	IVd	All months ex- cept I, VI, VIII, XII
Blattinae				
<i>Blatta orientalis</i> L. ⁵	No: Cosmopolitan	60, 73	VIII i	X, XII
<i>Periplaneta americana</i> (L.)	No: Cosmopolitan	60, 73, 83, 87, 102	VIII d	I, IV-V, VII-XI
<i>Periplaneta australasiae</i> (Fab.) ⁵	No: Cosmopolitan	60, 102, 120	VIII f	I, X
<i>Periplaneta brunnea</i> Burm. ⁵	No: Cosmopolitan	60	VIII f	VI
Oxyhaloinae				
<i>Leucophaea maderae</i> (Fab.)	No: Cosmopolitan	60, 73, 87, 102	VIII d	I, VII, IX, XI
Pycnoscelidinae				
<i>Pycnoscelis surinamensis</i> (L.)	No: Cosmopolitan	14, 32, 43, 66, 73, 83, 87, 101, 102, 104, 114, 117, 122	VII a	I-III, V-VII
Tiviinae				
<i>Zetha vestita</i> (Brullé)	No: Neotropical, Maca- ronesian, Hawaiian	14, 60, 98, 106	VII e	All months ex- cept IV, X

TABLE I, CONT.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
Epilamprinae				
<i>Leurolestes circumvagans</i> Burm. ⁵	No: Cosmopolitan	35, 102	VIII	I, V, XII
MANTOIDEA				
Amelinae				
<i>Ameles gracilis</i> (Brullé)	No: Mediterranean	5, 25, 26, 64	VIb	VI-VII, IX-X
<i>Ameles limbata</i> Brullé	No: Mediterranean	7, 12, 14, 20, 36, 51, 64, 73, 93, 117, 128	Ic	IV-VI, IX-XII
<i>Pseudoyersinia subaptera</i> Chop. (= <i>P. lindbergi</i> Chop.)	Yes: Tenerife & Lanzarote	22, 35, 43, 46, 66, 79, 81, 117	VIIIh	I, III-VI, XI
<i>Pseudoyersinia teydeana</i> Chop.	Yes: Tenerife	18	VIg	III, VI, VIII
Mantinae				
<i>Mantis religiosa</i> (L.)	No: Palearctic & Nearctic	3, 5, 60, 89, 91, 114, 124	Vc	VI-XI
Empusinae				
<i>Blepharopsis mendica</i> (Fab.)	No: Mediterranean	35, 43, 55, 73, 88, 102, 122, 124	VIIb	III-IV, VI, VIII-X
<i>Hypsicorypha gracilis</i> (Burm.)	No: N. African	7, 14, 48, 60, 66, 73, 83, 100, 102, 103, 111, 123	Vb	II-VIII
TETTIGONOIDEA				
Phaneropterinae				
<i>Phaneroptera nana sparsa</i> Stal	No: Mediterranean & Ethiopian	5, 9, 14, 18, 22, 43, 49, 51, 55, 58, 59, 60, 87, 88, 100, 102, 111, 117	Ia	All months ex- cept X
Meconeminae				
<i>Canariola nubigena</i> (Kr.)	Yes: Tenerife	5, 7, 14, 57, 67, 117	IIIb	II-IV, VI
<i>Canariola willemsei</i> Mor.	Yes: Tenerife & Gomera	5, 114	VIId	IX, XI
Tettigoniinae				

TABLE I, CONT.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
<i>Calliphona königi</i> Kr.	Yes: Tenerife	2, 3, 5, 14, 26, 39, 46, 60, 72, 83, 94, 111, 116, 119	IVc	IV-IX, XII
Decticinae				
<i>Ariagona margaritae</i> Kr.	Yes: Tenerife, Hierro, & Gomera	2, 5, 6, 7, 13, 29, 57, 63, 65, 77, 109, 111, 115	IVc	VII-XI
? <i>Platycleis denticulata</i> Panz.	No: W. Mediterranean	----	----	----
<i>Platycleis falx</i> (Fab.)	No: Mediterranean	----	----	----
<i>Platycleis grisea</i> (Fab.)	No: Palearctic	26, 114	VIf	VI, IX
<i>Platycleis intermedia</i> (Serv.)	No: Palearctic (especially Mediterranean)	14, 23, 67	VIIIf	IV-V, VII
<i>Platycleis sabulosa</i> Azam	No: W. Mediterranean	5, 7, 14, 23, 25, 49, 60, 69, 77, 83, 87, 110, 114, 117	IVc	III-VI, IX-X
<i>Tessellana tessellata</i> (Charp.)	No: Mediterranean & Cal- ifornian	5, 6, 60, 67, 77, 83, 91, 96, 114, 117	IIIa	III-V, VII-IX, XI
<i>Decticus albifrons</i> (Fab.)	No: Mediterranean	5, 7, 26, 60, 83, 87, 110, 112, 117	IIIa	III-IX, XI
GRYLLOIDEA				
Gryllinae				
<i>Gryllus bimaculatus</i> De G.	No: Afro-Asian & Medi- terranean	5, 8, 14, 26, 28, 43, 51, 60, 64, 66, 69, 71, 77, 83, 87, 89, 101, 102, 111, 114, 116, 125	IVb	All months
<i>Acheta meridionalis</i> (Uv.) (= <i>A. canariensis</i> Chop.)	No: Mediterranean	14, 24, 27, 37, 43, 60, 94, 102, 114, 117, 122	IIIc	All months ex- cept VI-VIII
<i>Acheta hispanicus</i> (Ramb.)	No: Mediterranean	5, 7, 14, 43, 60, 73, 114	IIc	III-V, VII-XII

TABLE I, CONT.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
<i>Tartarogryllus burdigalensis</i> (Latr.) ⁵	No: Mediterranean	73	VIIj	VII
<i>Modicogryllus guanchicus</i> (Kr.)	No: Spanish Sahara	7, 14, 24, 60, 90, 114, 117, 118	IVd	II, IV-VI, VIII, X
<i>Modicogryllus palmatorum</i> (Kr.)	No: Mediterranean & Ethiopian	17, 118	VIII	II, IV-V, IX
<i>Platygryllus brunneri</i> (Sauss.)	No: Almost tropicopolitan	23, 37, 101, 117, 118	VIIh	I, III-IV, VII, IX
<i>Gryllomorpha canariensis</i> Chop.	Yes: Tenerife	5, 18, 26, 27, 28, 45, 52, 64, 67, 111, 116, 117	VIa	I, VI, IX-XI
<i>Gryllomorpha longicauda</i> (Ramb.)	No: Mediterranean (Iberian & N. African)	-----	-----	-----
<i>Gryllodes sigillatus</i> (W.)	No: Tropicopolitan	26, 102	III d	VI, XI-XII
Mogoplistinae				
<i>Mogoplistes squamiger</i> (Fisch.)	No: Mediterranean & Madeiran	102	VIII	I-II, IX
<i>Cycloptiloides canariensis</i> (Bol.)	Yes: Tenerife	60, 69, 102	VIIe	I, XII
Trigonidiinae				
<i>Trigonidium cicindeloides</i> (Ramb.)	No: Afro-Asian & Mediterranean	60, 87, 109	VIIe	II, VI, X
Oecanthinae				
<i>Oecanthus pellucens</i> (Scop.)	No: Palearctic, especially Mediterranean	3, 5, 26, 27, 60, 64, 83, 87, 105, 114, 128	IVe	II, V, VII-XI
Gryllotalpinae				
<i>Gryllotalpa africana</i> (Beauv.)	No: Mediterranean & Ethiopian	53, 73, 93	VIII	IV, VI, X

TABLE I, CONT.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
ACRIDOIDEA				
Tetriginae				
<i>Tetrix subulata</i> (L.)	No: Holarctic	-----	-----	-----
<i>Paratettix meridionalis</i> (Ramb.)	No: Mediterranean	5, 43, 47, 53, 60, 73, 87, 101, 114, 117, 118, 124, 128	Ib	I, III-V, VIII, X-XII
Pyrgomorphae				
? <i>Pyrgomorpha cognata</i> Kr.	No: Mediterranean & Ethiopian	69	VIIg	II
Catantopinae				
<i>Arminda brunneri</i> Kr. (= <i>A. appen-</i> <i>hageni</i> End.) (= <i>A. striatifrons</i> End.)	Yes: Tenerife	2, 5, 7, 26, 27, 38, 46, 49, 64, 77, 85, 87, 93, 96, 111, 114, 115, 116, 117, 126, 128	IVa	All months
? <i>Arminda burri</i> Uv.	Yes: Tenerife & G. Cana- ria	127	-----	-----
Calliptaminae				
<i>Calliptamus plebeius</i> (Walk.)	Yes: Tenerife, G. Cana- ria, La Palma, Hier- ro, & Gomera	5, 7, 14, 15, 16, 18, 19, 21, 23, 26, 30, 40, 43, 44, 46, 49, 53, 55, 60, 62, 65, 70, 73, 80, 82, 83, 85, 86, 87, 88, 89, 93, 94, 110, 114, 115, 117, 124, 128	Ia	I, VI-VIII, X
Cyrtacanthacridinae				
<i>Schistocerca gregaria</i> (Forsk.)	No: Afro-Asian & Medi- terranean	4, 37, 60, 69, 73, 83, 102	Vc	I-II, IX-XI
Oedipodinae				

TABLE I, CONT.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
<i>Scintharista n. notabilis</i> (Walk.)	No: Mediterranean & S. Asian	9, 19, 42, 43, 53, 54, 55, 73, 93, 94, 102, 110, 117, 128	IIb	All months
<i>Oedaleus decorus</i> (Germ.)	No: Mediterranean & Ethiopian	3, 4, 5, 29, 60, 65, 91	VIId	IV, VI-VIII, X-XI
<i>Locusta migratoria</i> (L.)	No: Afro-Asian & Medi- terranean	3, 5, 14, 19, 23, 28, 37, 39, 43, 46, 60, 69, 73, 77, 79, 87, 88, 91, 93, 94, 102, 105, 114, 115, 117	Vc	All months
<i>Oedipoda caerulea</i> (L.)	No: Mediterranean	27, 55, 128	IIb	----
<i>Oedipoda canariensis</i> Kr.	Yes: Tenerife, G. Canar- ia, La Palma, Go- mera, & Azores	1, 19, 27, 46, 60, 64, 73, 79, 82, 93, 94, 102, 117	IIb	All months ex- cept II-III, VII
? <i>Oedipoda fuscocincta</i> Luc.	No: N. African	----	----	----
<i>Sphingonotus caeruleus</i> (L.)	No: Palearctic	77	----	----
<i>Sphingonotus canariensis</i> (Sauss.)	No: Mediterranean (N. African)	22	VIIk	IV
? <i>Sphingonotus lucasii</i> Sauss.	No: Mediterranean (N. African)	----	----	----
<i>Sphingonotus rubescens</i> (Walk.)	No: Afro-Asian, Mediter- ranean, & Madeiran	7, 14, 19, 22, 27, 37, 35, 43, 51, 54, 66, 69, 73, 79, 87, 88, 94, 102, 108, 110, 111, 117, 128	Ib	All months ex- cept VII
<i>Sphingonotus savignyi</i> Sauss.	No: Mediterranean	37, 44, 73, 74, 117	VIIIi	I, III-IV, VI-IX, XI
<i>Sphingonotus willemsei</i> Mists. (= <i>S. teydei</i>)	Yes: Tenerife	18	VIg	VII-IX
? <i>Wernerella aspera</i> (Brullé)	No: Mediterranean	----	----	----

TABLE I, CONT.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
<i>Wernerella picteti</i> (Kr.)	Yes: Tenerife & Gomera	19, 21, 22, 27, 43, 46, 55, 70, 73	IIb	I, III-VI, VIII-X, XII
<i>Acrotylus i. insubricus</i> (Scop.)	No: Mediterranean	10, 22, 31, 43, 54, 55, 66, 69, 87, 88, 93, 102, 111, 114, 128	VIIa	I, III-IV, VII-VIII, XI-XII
<i>Acrotylus longipes</i> Charp.	No: Mediterranean	43, 73, 75, 128	IIc	I, III-IV, VI, VIII-X, XII
<i>Acrotylus patruelis</i> (H.-S.)	No: Mediterranean & Ethiopian	5, 7, 14, 19, 23, 26, 28, 29, 37, 43, 51, 60, 64, 69, 73, 77, 83, 87, 88, 93, 94, 99, 100, 102, 105, 107, 110, 114, 117, 128	Ib	All months
<i>Aiolopus strepens</i> (Latr.)	No: Mediterranean & Ethiopian	2, 3, 5, 7, 14, 15, 16, 18, 23, 27, 28, 43, 46, 51, 55, 60, 64, 69, 77, 83, 87, 88, 93, 94, 99, 101, 102, 105, 111, 114, 116, 117, 128	IVa	All months
<i>Aiolopus thalassinus</i> (Fab.)	No: Mediterranean & Ethiopian	7, 22, 23, 29, 32, 37, 43, 49, 51, 55, 60, 69, 77, 83, 87, 88, 90, 91, 93, 94, 99, 102, 109, 110, 111, 114, 116, 117, 120, 124	Ib	All months
Gomphocerinae				
<i>Stenohippus epacromioides</i> Krauss (=S. bonneti)	No: Ethiopian & Cape Verdean	19, 34, 66, 73, 76, 93, 94, 95, 102, 117	VIIh	All months ex- cept II, VII
<i>Dociostaurus maroccanus</i> (Thunb.)	No: Mediterranean	5, 23, 26, 29, 46, 53, 60, 65, 70, 77, 87, 88, 93, 110, 114, 117	IVb	III-IX, XII
Truxalinae				

TABLE I, CONT.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
? <i>Truxalis nasuta</i> (L.)	No: Mediterranean & Ethiopian	69	VIIg	II
PROTODERMAPTERA				
<i>Anataelia canariensis</i> Bol.	Yes: Tenerife & Gomera	14, 41, 87, 125	VIIg	All months
DERMAPTERA				
Labiiduridae				
<i>Labidura riparia</i> (Pall.)	No: Cosmopolitan	31, 73, 84	VIIj	I, III-VI, VIII-IX, XII
<i>Euborellia annulipes</i> (Luc.)	No: Cosmopolitan	3, 5, 7, 13, 14, 23, 26, 29, 50, 53, 60, 64, 69, 73, 77, 83, 84, 87, 101, 102, 109, 114, 116, 117	Va	All months except VII
<i>Anisolabis maritima</i> (Géné)	No: Cosmopolitan	5, 18, 22, 37, 73, 77, 84, 93, 102, 113, 116	IIa	III-V, IX-X, XII
<i>Anisolabis maxima</i> (Brullé)	Yes: Tenerife, G. Canaria, Hierro, & Gomera	3, 5, 7, 8, 13, 14, 15, 18, 26, 28, 60, 65, 77, 102, 107, 109, 111, 114, 115, 116, 117	IVa	All months
Labiidae				
<i>Labia minor</i> (L.)	No: Cosmopolitan	14, 60, 87, 88, 115	VIIe	III, VI, XI-XII
Forficulidae				
<i>Perirrhytus edentulus</i> (Woll.)	Yes: Tenerife, G. Canaria, Gomera, & Madeira	5, 33, 60, 115	IVc	I, III-VI, VIII
<i>Forficula auricularia</i> L.	No: Holarctic	2, 5, 7, 14, 23, 26, 28, 43, 49, 50, 60, 73, 77, 102, 105, 107, 111, 113, 114	Va	All months except VII-VIII

TABLE I, CONT.

Groups & Species	World Distribution & Endemism ⁶	Tenerifean Distribution ⁷	Tenerifean Distribution Type ⁸	Adult Seasonal Periodism ⁹
<i>Guanchia cabreræ</i> (Bol.)	Yes: Tenerife & G. Canar- ia	2, 7, 13, 14, 20, 28, 33, 111, 115, 116	IVd	All months ex- cept VII-VIII, XI-XII
<i>Guanchia canariensis</i> Burr	Yes : Tenerife	2, 7, 77, 85, 92, 111, 115, 116	VIa	III-VII
<i>Guanchia guancharia</i> (Hell.) ⁵	Yes: Tenerife & G. Canar- ia	5, 13, 26, 77, 117	VIc	II, V-VII, X
<i>Guanchia uxori</i> (Hell.)	Yes: Tenerife	2, 5, 7, 8, 18, 26, 65, 68, 85, 92, 111, 115	VIa	I-VI

⁵ Species whose distribution, as shown here, is open to question, being based on 10 or fewer specimens.

⁶ If *yes*, the species is endemic, and the Canarian islands where it occurs are indicated; if *no*, it is not a Canarian or Macaronesian endemic, and its world distribution is noted.

⁷ The distributional records here given are based on the collections of M. Morales Martin, those of the Laboratorio de Zoologia of the Museo Insular de Ciencias Naturales, Santa Cruz, and those of the Instituto Español de Entomología, Madrid, except for the italicized records, which are from literature cited. The numerical code to distribution appears on pp. 4-5.

⁸ The explanation of distributional types here used is given on pp. 7-8 and in Plates I-IV.

⁹ The months in question are given in Roman numerals from I (January) through XII (December).

TABLE II

Meteorological Data of Selected Tenerifean Localities, After World Weather Records (Vol. 6, 1968), Atlas Nacional de España (1965), and Ceballos and Ortuño (1951).

City	Region	Elevation (in m.)	Av. Annual Rainfall (in mm.)	Av. Feb. Temp. (in °C.)	Av. Aug. Temp. (in °C.)	Total Av. Annual Hrs. of Sun	Total Av. Overcast Days/Year
La Orotava	Northern coast	100	406.0	16.4	22.9	---	111
La Laguna	East central ("Laguna Belt")	547	568.4	12.3	21.1	2,216	64
Los Rodeos	East central ("Laguna Belt")	641	777.0	11.8	19.2	2,374	---
Izaña	Central	2,367	649.8	3.7	17.5	3,314	31
Santa Cruz	Southeastern coast	46	325.9	17.3	24.6	2,896	26

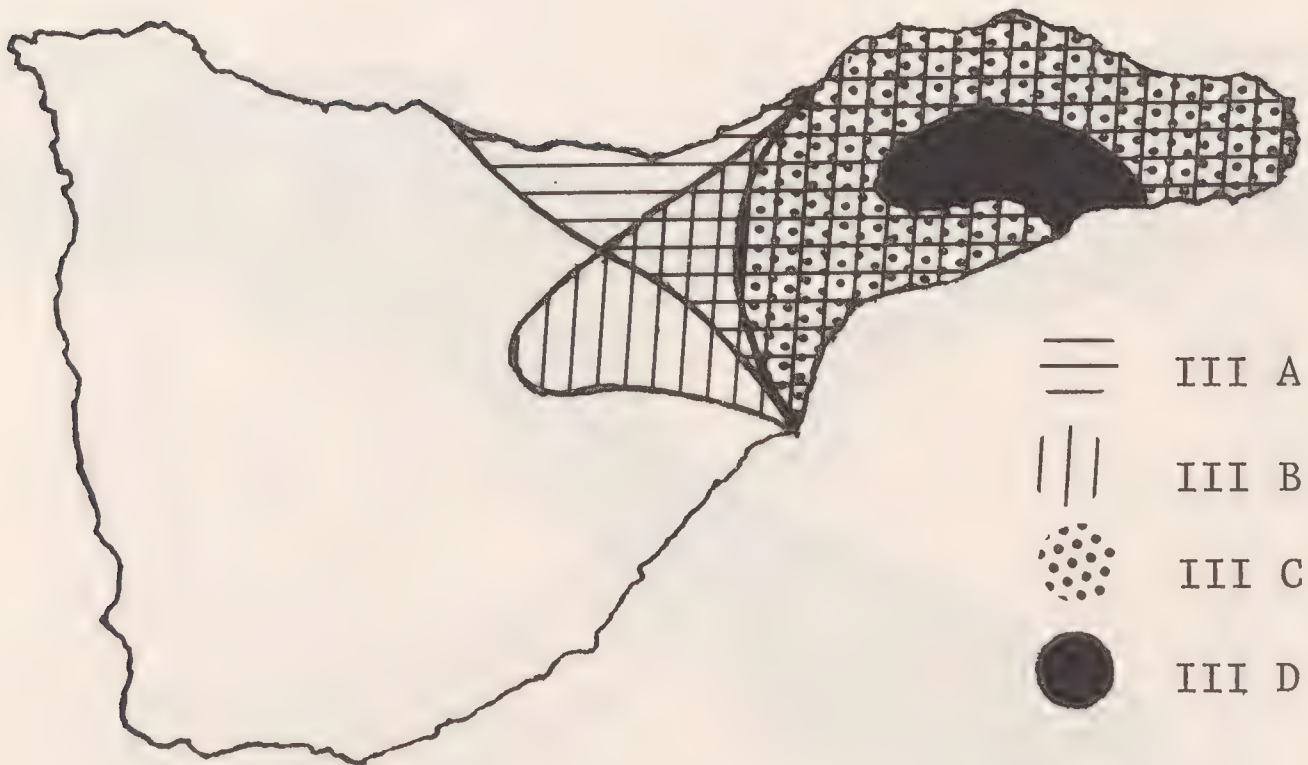
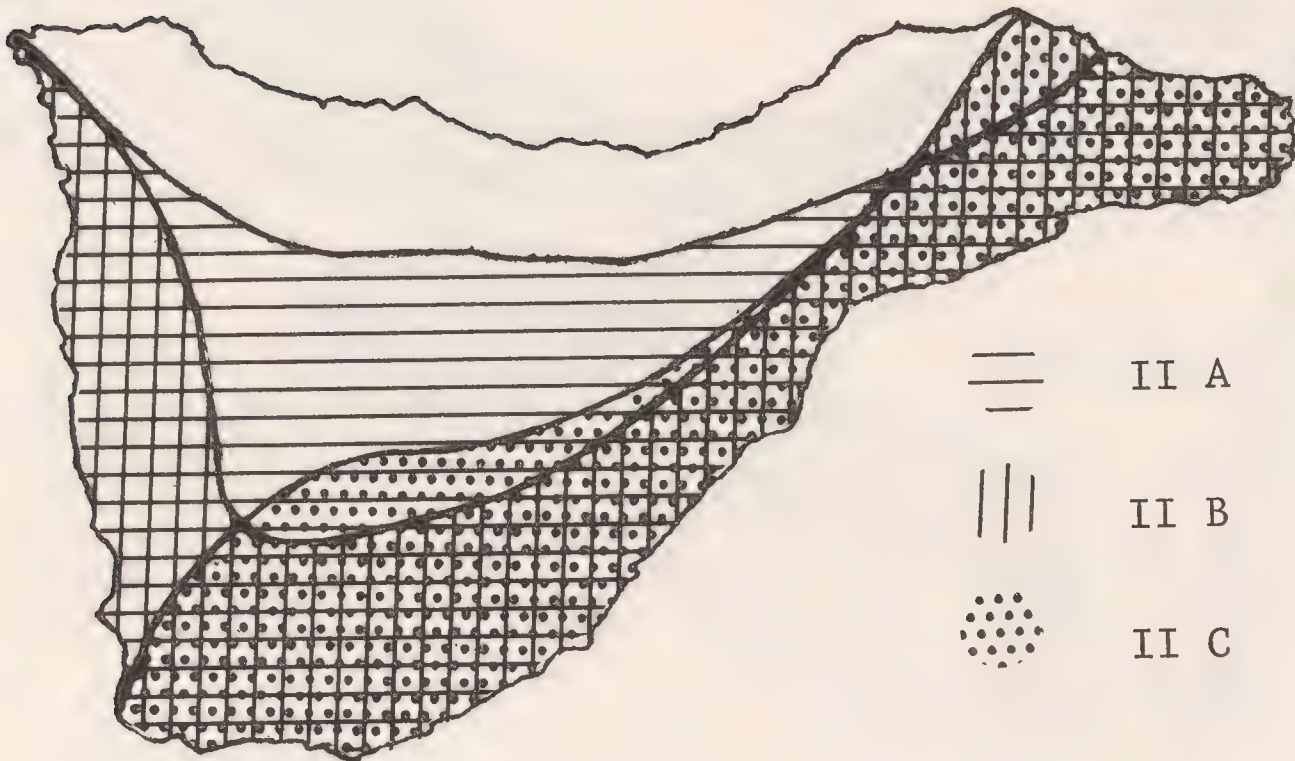
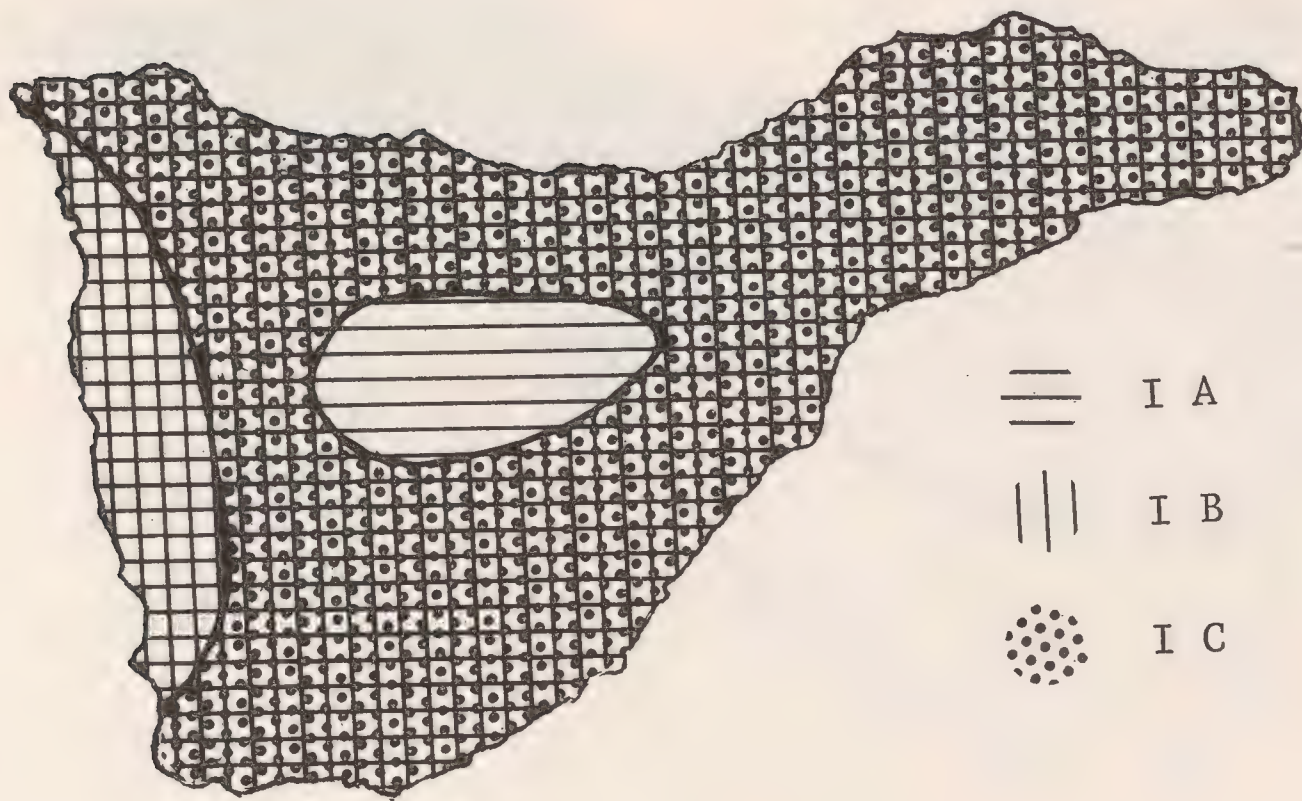


PLATE I. Orthopteroid distributions in Tenerife, as recognized in this report: Distribution Types I-III.

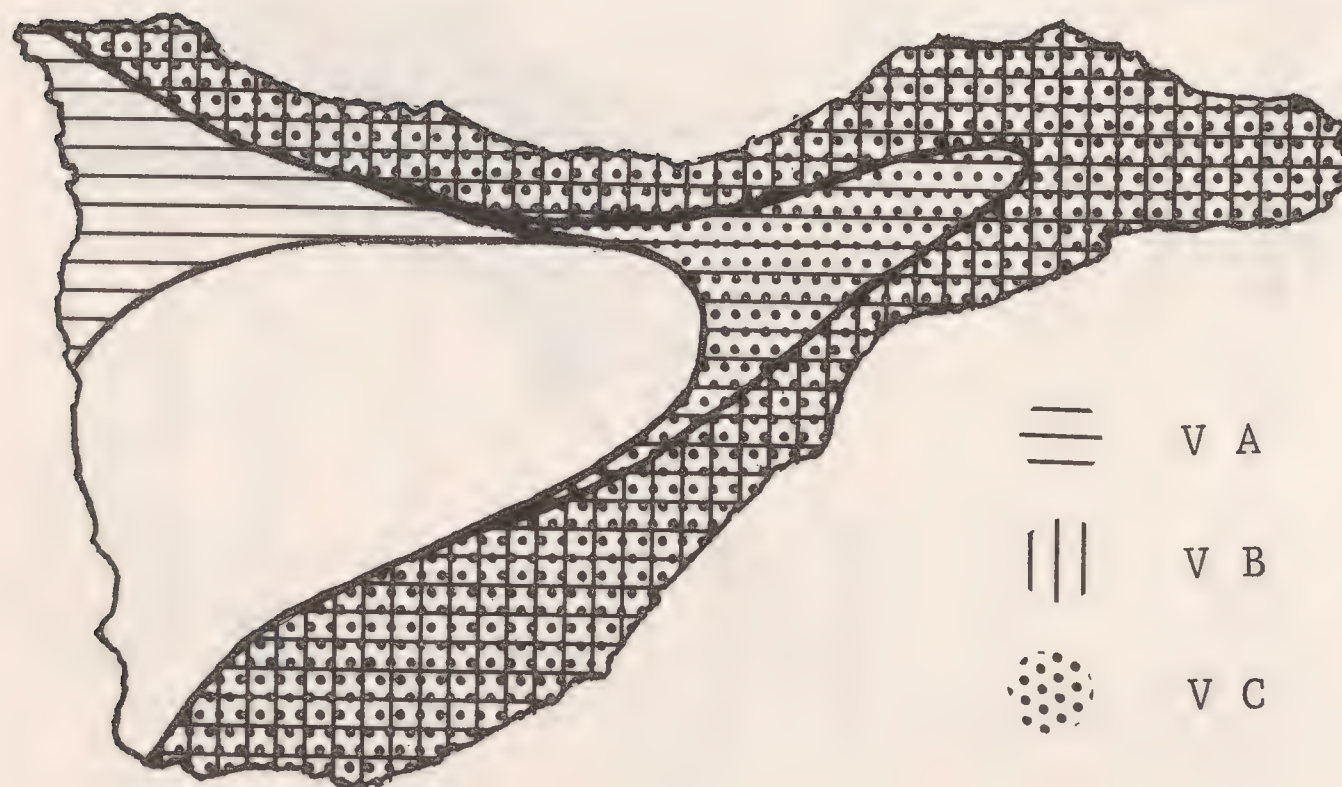
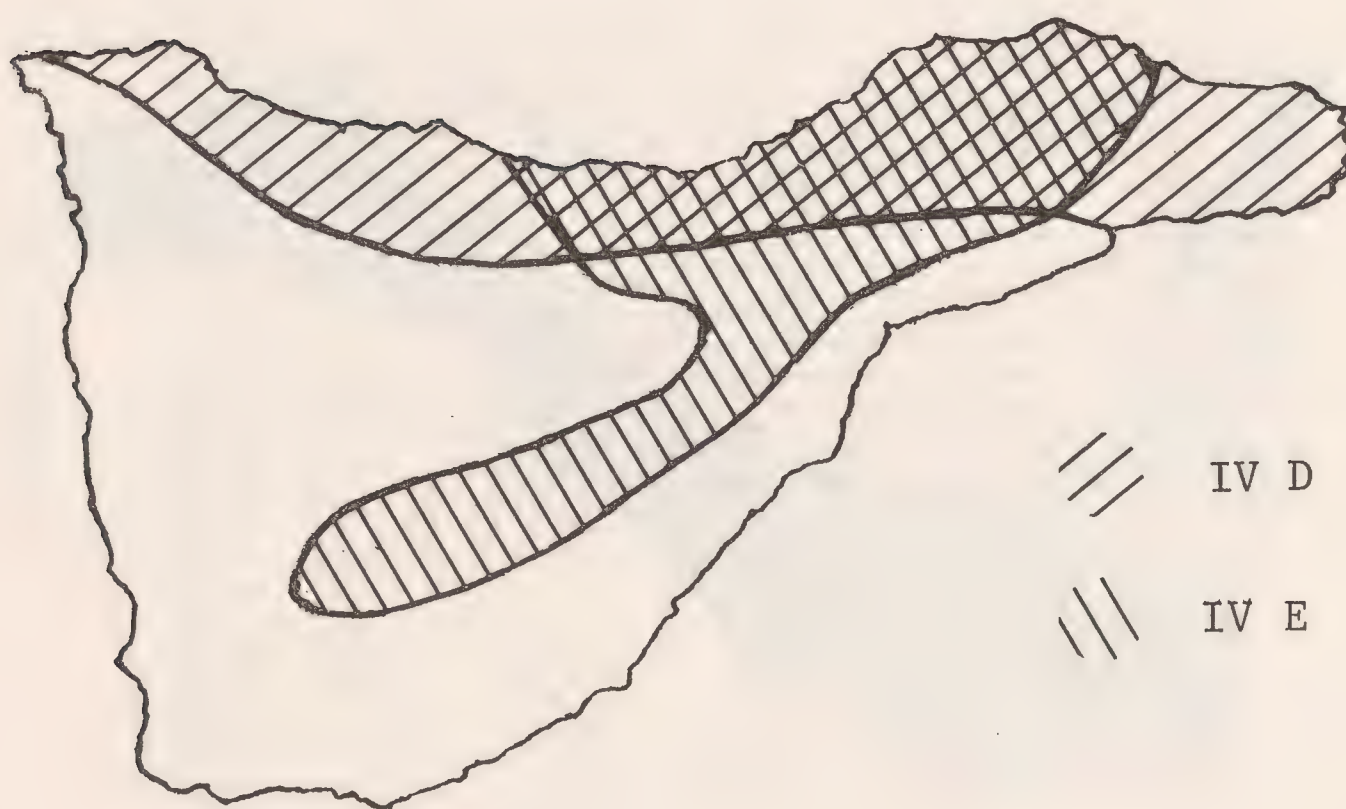
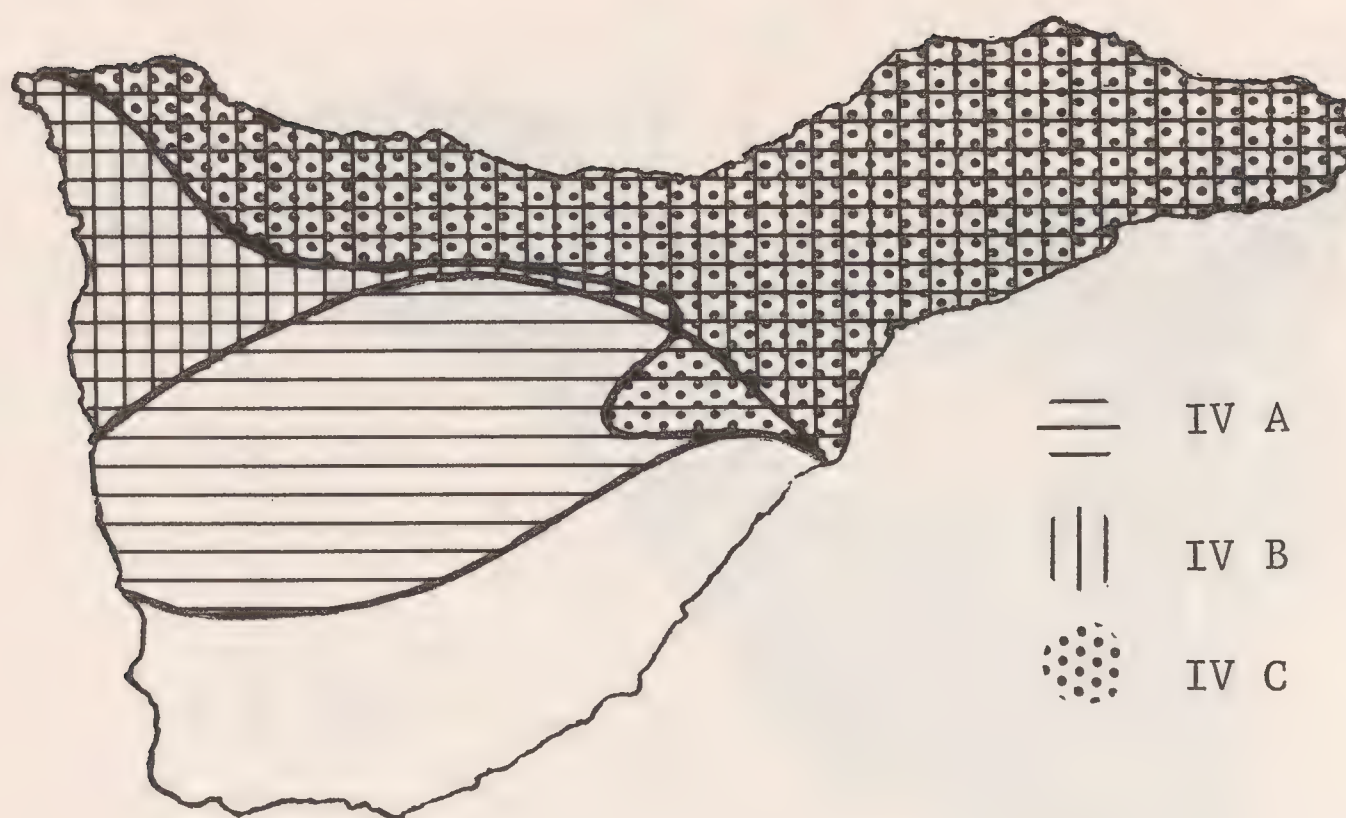


PLATE II. Orthopteroid distributions in Tenerife, as recognized in this report: Distribution Types IV-V.

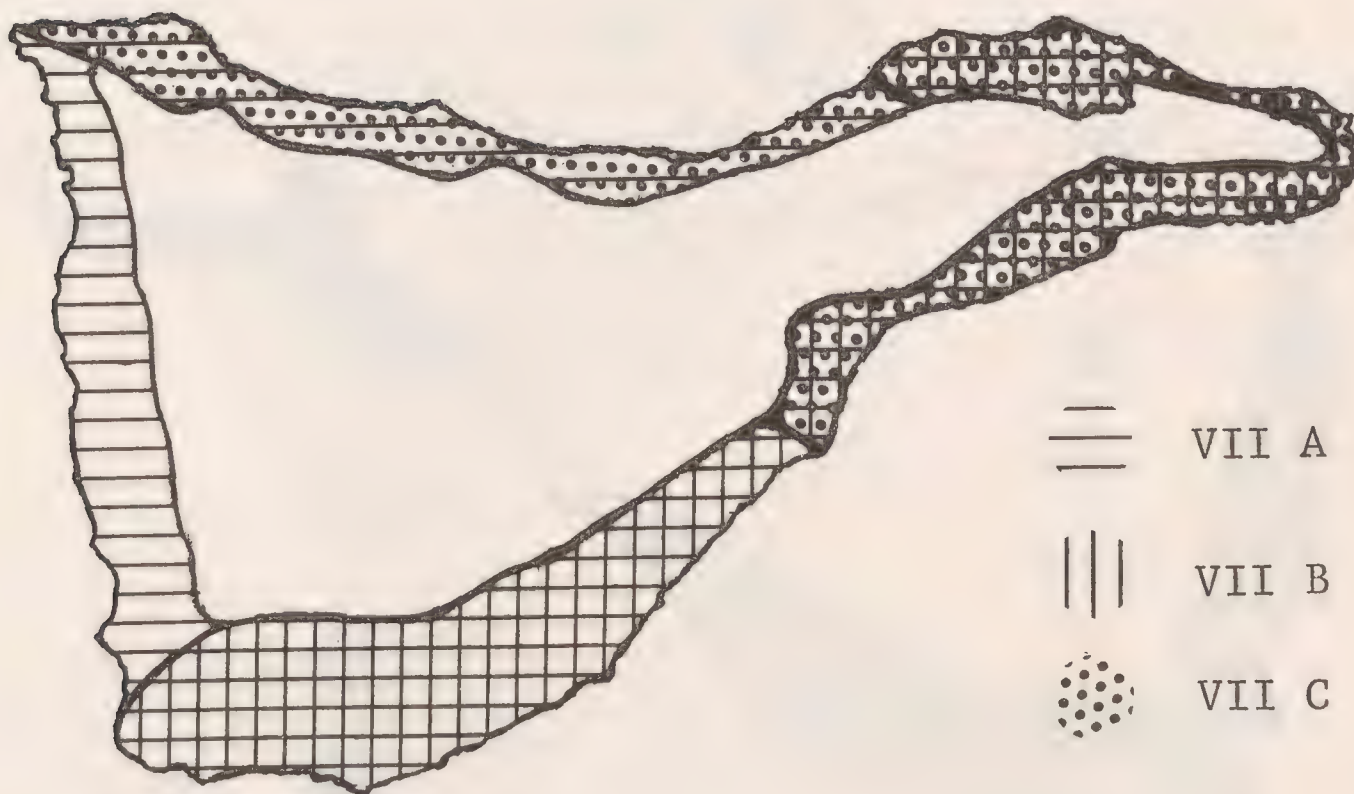
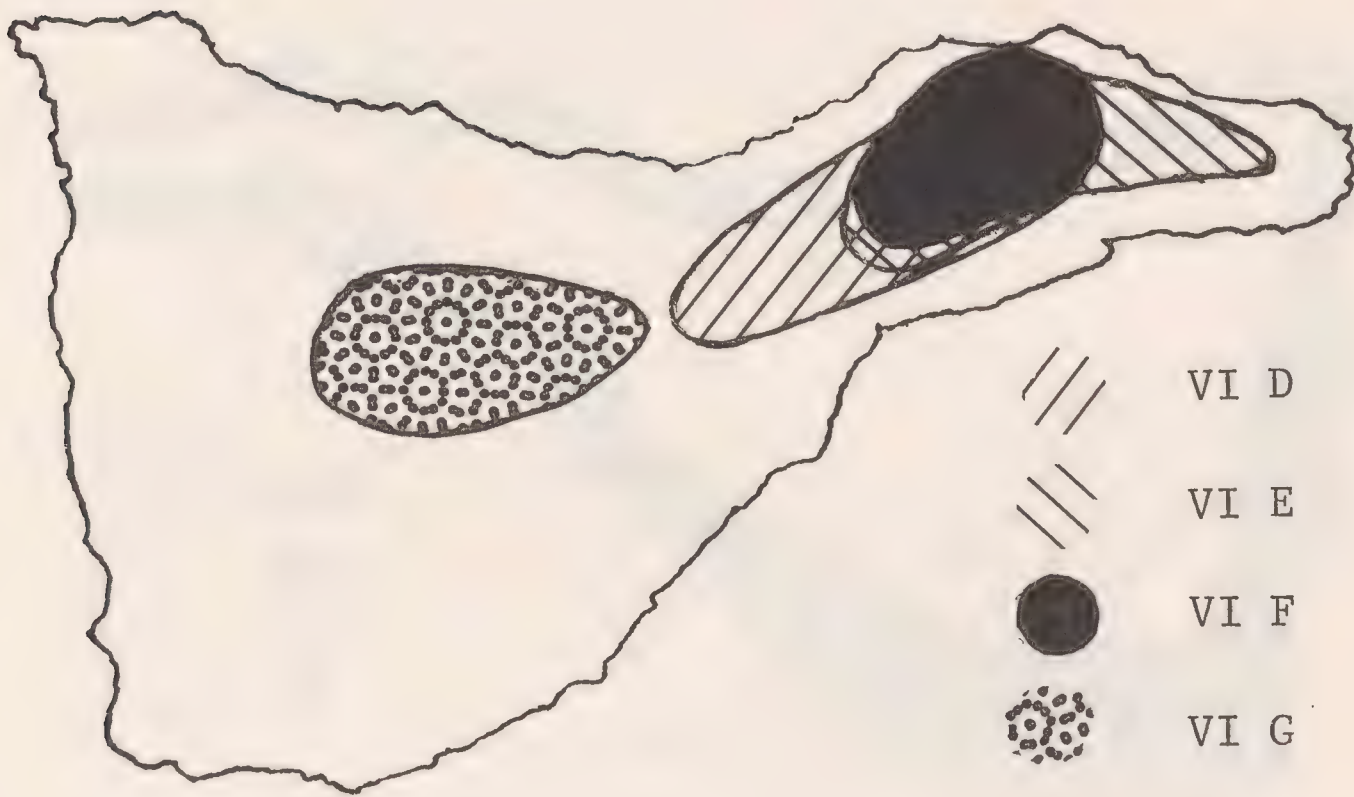
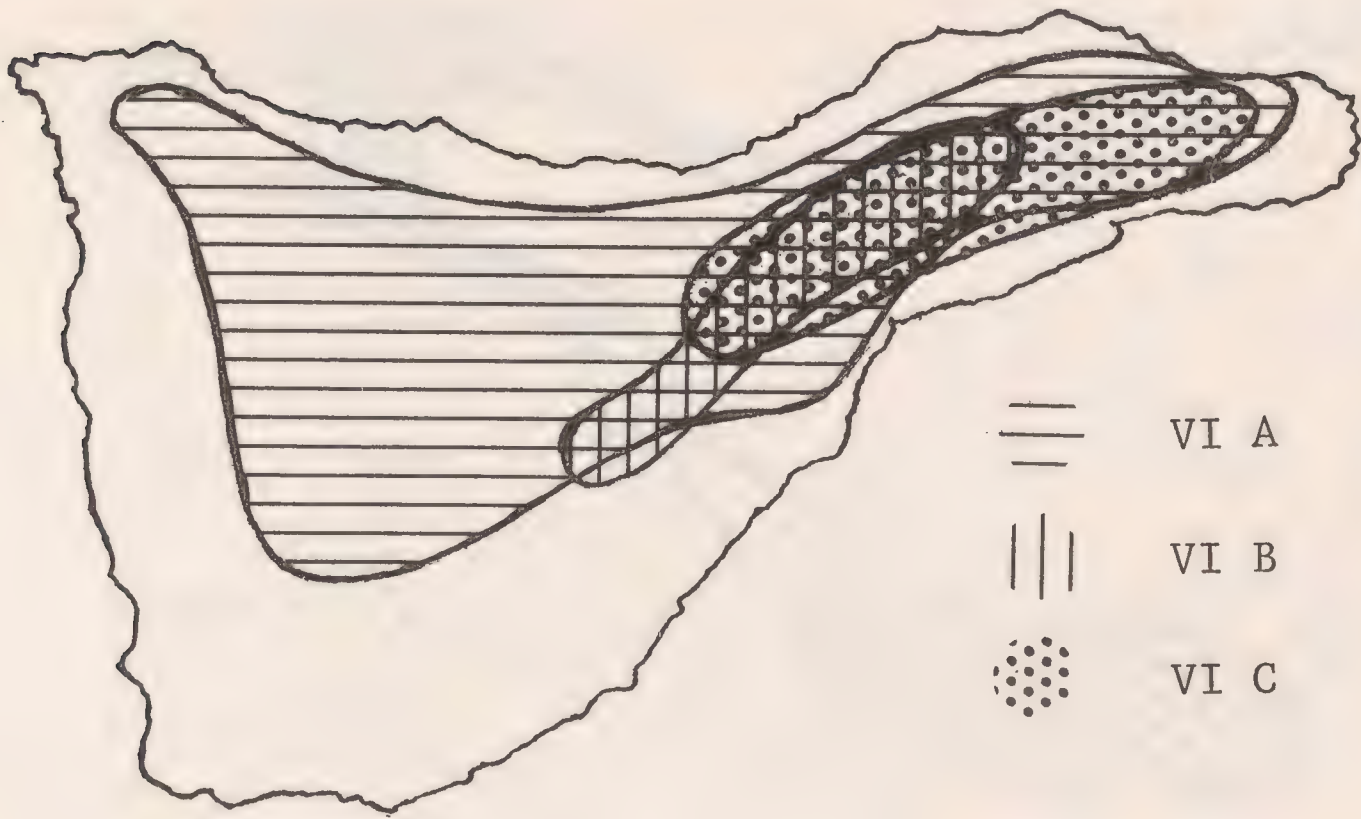


PLATE III. Orthopteroid distributions in Tenerife, as recognized in this report: Distribution Types VI-VII.

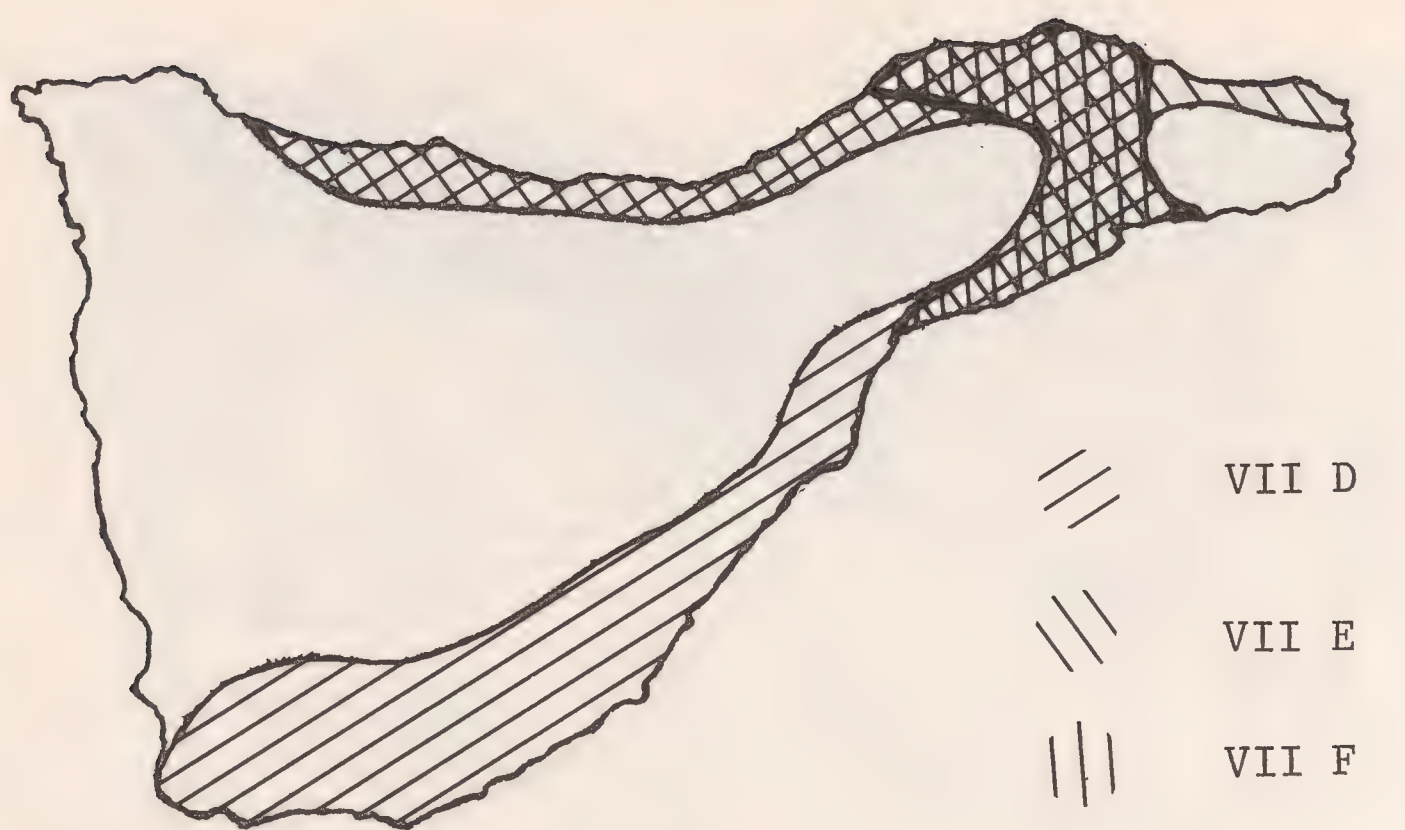


PLATE IV. Orthopteroid distributions in Tenerife, as recognized in this report: Distribution Types VII, Continued.

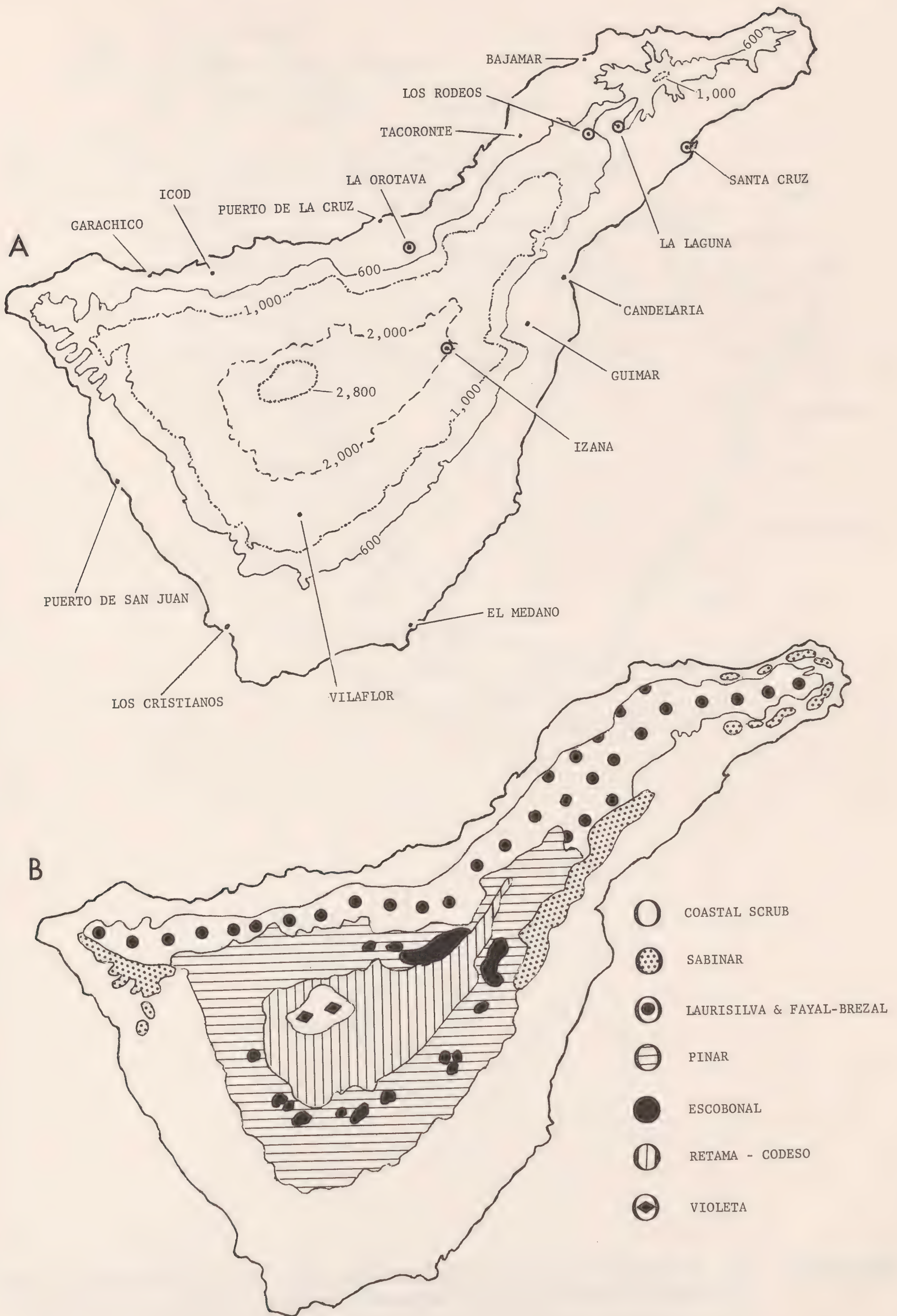


PLATE V. A. Elevational zones and selected localities of Tenerife. The encircled dots indicate places listed in Table II. B. Phytogeographic regions of Tenerife, after Ceballos and Ortuño (1951).

